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OF THE
AMERICAN STATISTICAL ASSOCIATION

MARCH, 1927

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THE DILEMMA OF THE NEW STATISTICS[1]

By Leonard P. Ayres

During recent months a large industrial corporation has been endeavoring to employ a competent statistician to fill an important position at an annual salary of $25,000. They have been unable to fill the position, and have made other arrangements. Their explanation of the matter to me is that when they considered the qualifications of statisticians recognized as young, progressive leaders in the profession they found that they could not read the statistical material that these men had published, and could not understand what the statisticians were talking about when they tried to discuss it with them.

They were no better off when they found statistical workers whose writings and discussions they could comprehend, for they found that these men were not generally regarded by their fellow workers as really being in the first rank among skilled statisticians. We should be gratified that a business firm was willing to offer so high a salary to fill a statistical position. And we should be concerned that statisticians appeared to find a negative correlation between ability and lucidity. How shall we explain this?

The fact is that the science of statistics has entered a new era, and is now at a stage of development where the extensions of its methodology have outstripped the arts of exposition necessary to tell about them. The great war marked the transition from the old to the new statistics.

We are met in the eighty-eighth annual convention of the American Statistical Association, but this is only the twentieth annual presidential address. The published records of these meetings during the decade before the war show that those presidential addresses deplored the fact that the Association had not introduced any new methods to statisticians, commented on the lack of trained workers, and claimed

[1] Presidential address to the eighty-eighth annual meeting of the American Statistical Association at St. Louis, December 29, 1926.

that the universities had failed in their attempts to teach statistics. I think it can fairly be said that when the speakers on these occasions before the war directed their attention to the problems of the profession their pleas were for the development of methods, and for the training of statisticians.

If we look back as far as thirty years we find that General Francis A. Walker, addressing the Association in Washington in 1896, said: "I do not know of a single man now holding, or who has ever held, a position in this country as the head of a statistical bureau, or as chief of a statistical service, or as a statistician, who has had any elementary training for his work."

Ten years ago the great war was tearing at the vitals of civilization. When we entered it there arose an insistent call for statistics, but in banking terms the call was for statistics on demand, and not for statistics on time. Now previous to the war most statistical work was carried on by the government, and most of the series of data were published in annual figures, which were likely to be available about eighteen months after the end of the year. The pursuit of statistics was in the main rather leisurely, somewhat academic, and usually remote from practical use.

Beginning with the war, and since then, all this has changed. The data of government, business, and finance are available monthly, weekly, and even daily. The fields of inquiry have enormously multiplied. Well trained statisticians have appeared, and many of them. There arises on every hand the demand that statistics shall be published and interpreted currently, and that they shall be projected into the future.

Now these demands for statistical forecasts are in reality merely new and difficult phases of an ancient problem. Society has always asked for prophecy, and always demanded it of the statistician, for all human prophecy is statistical. But exact prophecies have been possible only in the exact sciences, and as soon as they have become exact society has given them special names, and entrusted their extension to special groups, so that they are not now known as statistics.

The measurement of time, the marking of the passage of the years, the forecasting of the procession of the seasons was probably the earliest branch of statistical prophecy. The prediction of the movements of the stars must have followed as an extension of early statistical forecasting. Still later on the statisticians told what the tides would do. Long after these early beginnings, and indeed only after the development of the telegraph, came the statistical work of weather forecasting, but that again is no longer statistics. There is perhaps

only one field of recognized prophecy that statistics has retained as a specialized branch, and that is the prophecy of insurance. Once more I would ask you to note that all prophecy that is not supernatural is statistical. Note also that society is now demanding prophecy in such diverse and inexact fields as those of crop acreage, price movements, interest rates, school progress, building construction, industrial output, and most of all as to the course of general business.

The advent of the new statistics has brought with it a great profusion of data, and also a wide extension of the demands on the statistician. Before the war the chief demands were for straightforward numerical description, and for the analysis of past conditions. Most of the results were stated in simple aggregates and averages. With the new statistics these more elementary tools are no longer adequate.

The most obvious characteristic of the new statistics is that its methods are complicated, and its terminology made up of strange words. The statistician dealing with a distribution of observations, instead of a convenient total, uses the mean, or the median, or the mode to express some center of the group, and the standard deviation, or the probable error, or the semi inter-quartile range to measure the scattering of the individuals from the center.

By progressive steps he develops empirical equations to express relationships between variables, and plots regressions, or parabolas, or other graphic curves mathematically derived to represent the working out of these equations. This leads in turn to still more complicated methods of calculating relationships between variables by means of rectilinear or curvilinear correlation formulas. The use of such methods has brought into the new statistics a whole vocabulary of strange terms, a multiplication of mathematical symbols, and a varied collection of Greek letters that are incomprehensible to the uninitiated, but a source of deep satisfaction to those of the inner cult.

During the years before the war almost no papers appearing in the JOURNAL of the Association employed elaborate mathematical terminology or symbols. In the past five years half of them by actual count have been of that sort, and in the past two years two-thirds of them. The new statistical textbooks and treatises on method have undergone a corresponding change, so that it is now true of most of them that if you need to read them you can't, and if you can read them you don't need to.

Through this evolution a majority of the members of the profession have in this past decade been rendered statistically illiterate when confronted by the writings of their fellows. This new condition explains the bewildered difficulty of the firm that sought to employ a

skilled statistician to illumine their problems. The dilemma of the new statistics lies between the recondite treatment of the difficult problems on the one hand, and the means of communicating the results intelligibly on the other.

Two major questions are at once suggested. The first is whether or not these newer methods are essential or highly valuable in attacking the problems with which statisticians must now deal. I think the answer is *yes*.

It is affirmative because all the fields of work in which statisticians are breaking new ground are fields in which no set or series of conditions is ever repeated. They are the fields of biology, psychology, education, sociology, economics, agriculture, and business research. If these were more nearly exact sciences we could proceed as do the fortunate students in many other fields who can repeat and vary their experiments, while progressively controlling the conditions, and limiting accessory variations, until finally it becomes possible to draw truly general inferences.

Our fields of work do not permit that. They have to do with living organisms, and for the most part with the behavior of human beings. Because this is true the observations are scattered; relationships are at best only approximations; cause and effect are blurred. We cannot repeat experiments under identical conditions, or purposely varied ones, and because such control is unattainable we must employ the tools of statistical analysis through which we can replace the scattered distributions of the original observations by the mathematical expressions which will most truly represent them. After we have done this we can deal with these conventionalized mathematical substitutes so as to formulate the concomitancies and relationships that exist between the associated series of evidence.

The very end and aim of the new methods is this statistical formulation of observed relationships. It is seldom or never a seeking after laws, for in these humanistic studies of ours the observations do not yield results of such degree of universality that we may ennoble them by designation as laws of nature. Our figures deal with life. They are expressions of nature's infinite variety. We are seeking to measure trends. We try to identify controlling factors. Our work aims to discover the relative importance of different contributing influences. The final purpose is the statistical formulation of observed relationships.

Notable progress toward doing this has already been made in the statistical study of biology. More than a beginning has been made in agriculture, in education, and in psychology. Only slight progress

has been made in doing it for economics, rather less than that in business research, and almost none at all in sociology. But much of the evidence in all these fields is numerical. We identify and discuss quantitative relationships in them. It seems clear that progress in extending the boundaries of our knowledge is dependent on the discovery of the generalized statistical relationships existing between such matters as supply and prices, prevailing interest rates and changing security values, prosperity and dependency, physiological maturity and school progress, advancing crop prices and acreage increases, and scores more of fundamentally important factors in our practical and theoretical problems.

We may be confident that with rare exceptions we shall need the tools of the new statistics to formulate these relationships. We need their help to penetrate behind the deceptions of things as they seem, so as to see them as they are. I am not arguing that when we have these formulations of relationship we shall have advanced our sciences by the discovery of direct cases of cause and effect, for it is not probable that such advances are often made that way. I am arguing that if we can formulate generalities of relationship we may then, and not until then, have justifiable hopes of discovering the reasons for them. If we can state the relationships we can study them, test them, experiment with them, and perhaps ultimately explain them. It is in order to do this that we need the methods of the new statistics.

The second question about the new statistics is whether or not it is essential that the statement of its processes should continue to be obscured by cryptic mathematical symbolism and abridged complexities of verbiage involving inferential leaps in the dark. I think the answer is *no*.

The fact is that most of the mathematics called for by the Greek letters and strange symbols of the new statistics is plain arithmetic with sometimes a little elementary algebra added. The proof that this is so is found in the fact that most of it is being computed daily by clerks who are accomplishing their tasks by using the mathematics they had acquired by the time they reached the eighth grade. There is now being conducted in Washington a statistical training course in the methods of multiple curvilinear correlations, and no prerequisites of mathematical training beyond elementary arithmetic are demanded for admission.

It is true that higher mathematics are needed for the derivation of some of the formulas in common use, and that in a larger proportion of cases they must be called upon for the demonstration of the validity of the formulas. But most statistical investigation does not require the

development of new formulas, or the demonstration of the validity of old ones. If it did most of us would be hard put to it to justify our procedure when we divide one simple fraction by another by turning the second one upside down and multiplying. Perhaps, too, our defense of long division would be no less difficult.

Probably the true reason why the recent writings of mathematical statisticians are such hard reading is that their writers wrote them for their fellow statisticians to read. They never intended that they should be intelligible to such persons as the presidents of their universities, the heads of their corporations, or the chiefs of their governmental departments. The new statistics has been developed by rather lonely men who rightly coveted the respect of their professional fellows, but who cherished the satisfaction of belonging to a select group which had been initiated into the mysteries of a new and highly restricted fraternity.

In some measures statistics has been afflicted by the snobbery of science in which each branch seeks to rise in the social scale by imitating the methods of the next more exact science. In our case we have been imitating mathematics which is not a science at all, but rather a specialized form of logic. It does not seek the truth, but only the exactitude of the deductive process. It is necessary for the mathematician doing new work to follow through the derivation of his process, and to demonstrate the validity of his method, but it is not often necessary for the statistician, because he is usually working in new material with old and tested methods.

The dilemma of the new statistics has its origin in the fact that the workers of the new school with their elaborate equipment of technique have temporarily shifted the emphasis of statistical work from the purpose of the inquiry to the process by which it is conducted, from the stubborn facts to the subtle figures, from the material to the mathematics. The cart is before the horse, and the horse is running away.

I have two pleas to make. The first is addressed to all statistical workers whether they call themselves statisticians, economists, psychologists, sociologists, or bankers, or by some other name. It is that they overhaul their statistical equipment and make good its deficiencies. For most of them this will require that they familiarize themselves with modern methods of three kinds: First, those used in dealing with frequency distributions. Second, those used in the analysis of time series, including the measurements of trends, and those of seasonal and cyclical fluctuations. Third, measurements of relationship.

For many of the mathematical statisticians the making good of deficiencies in technique will require that they learn the arts of which

the old governmental statistician is master; how to draw up a workmanlike tabulation, how to write a good title for the table after it is made, how to draw an effective statistical diagram, and how to keep in mind the fundamentally important facts of population statistics which underlie almost all other statistics.

I especially emphasize the plea that individual statistical workers should proceed forthwith to modernize their statistical equipment. I would go farther and term it an essential necessity, for the accumulating evidence clearly indicates that the statistician who fails to familiarize himself with the new statistics will within the next decade find himself unable to retain a position of importance in the profession.

My second plea is addressed to all writers on statistical subjects, and it is that they set themselves to the task of mastering the art of expression characterized by lucid brevity. And I would point out that in my first plea I have done my best to help make a market for the literary output of the first competent mathematical statistician who will write a book explaining those methods of the new statistics that he can himself remember without looking them up, stating them in simple English, and without omitting any of the steps.

For such an author fame and fortune are waiting, and an opportunity to turn his thoughts from an absorption that is selfish to a service that is social. Such a book would be immediately, although perhaps secretly, purchased by every statistician, every economist, and every worker in business research. Probably it would not be adopted by colleges, for the newest and best of the college textbooks have in their back pages glossaries of mathematical symbols covering upwards of 100 items. But this would not impair the sales, for every student would purchase the book as a trot, and use it to translate the assigned text.

After all, statistics is essentially explaining, and the most competent statistician is the one who can most effectively interpret and explain the evidence that is hidden in the figures. Two qualities he needs to cultivate. One is the verifying habit of mind. The other is that spare and vivid precision that everywhere characterizes thoroughbred expression, whether spoken or written.

The value of statistics is directly and almost completely dependent on the quality of the presentation. The chemist, the physicist, the astronomer, the physiologist, and most other scientific men, have appeal to material facts to support the validity of their findings, and to demonstrate the degree of importance of their results. The statistician has only his explanation of what the figures mean. If he is a good explainer, he is a good statistician, and conversely.

It will not do to protest that the president of the firm employing a

skilled industrial chemist values his services highly even though he does not understand chemistry, and that by analogy it is unfair to ask of the statistician that he reveal so far as may be the processes that he has employed. The chemist develops a process which he claims will produce a desired result, and if it will, the result is his complete justification. The business statistician has no such direct appeal to facts. What he does is to interpret the meaning of figures relating to matters with which the employer has had long, intimate, and successful contact, and which he feels entirely competent to discuss. It is not surprising that he is disappointed when he finds that he cannot read what the statistician has written, or understand what he is talking about when he explains his findings.

I am not discussing the popularization of statistics. Just now I am not particularly interested in it. My primary interest is in seeking the reëstablishment of the lines of communication between two groups of statisticians, for these lines have broken down. In addition I am concerned about building up the means of communication between the makers of statistics and the users of them, for until statistics are available they are not valuable.

In the past half dozen years there has spread through the English-speaking world a notable movement that has for its object the humanizing of knowledge. It has found its expression in such books as Well's *Outline of History*, Durant's *Story of Philosophy*, Thompson's *Outline of Science*, Slosson's *Creative Chemistry*, and Dorsey's *Why We Behave Like Human Beings*.

These are not popular books in the formerly accepted use of that term, although it is to the great credit of the English-speaking peoples that they have become best sellers. They are books which give evidence of the spread of the conviction in the minds of thoughtful men on both sides of the Atlantic that the future of our civilization depends on the widening spread and deepening hold of the scientific habit of mind. These books are intellectual keys by which intelligent students can open doors that have hitherto been shut to them, partly because they could get no glimpse of the treasures behind them, and partly because the portals were barred by barricades of unnecessary technicalities.

The possibility of humanizing knowledge has been demonstrated in physics, chemistry, history, philosophy, biology, anthropology. The time has come for a beginning to be made in the new statistics.

THE COMPETITIVE FACTOR IN SKEWNESS

By Howard J. Banker, *Carnegie Institution of Washington, Department of Genetics, Cold Spring Harbor, N. Y.*

The frequencies of simple biological phenomena have been repeatedly shown to approximate in distribution the Gaussian or normal probability curve. So evident is this that it has led to the generalization as a fundamental law that biological variations are normally of the probability type. There is a truth in this that is of value in its practical applications if one is careful to keep in mind the natural limitations, but the human mind is prone to mount a generalization and ride beyond the limit. As Professor Edwin B. Wilson[1] has recently remarked, "The emotional reaction to a mathematical, even to a simple arithmetic statement, is often extreme. Many persons like to tease others into the spinning of yarns; under which provocation figures and formulas make first rate liars; but why one then takes them so seriously I cannot imagine."

Such mental attitudes frequently lead to forced interpretations of phenomena in conformity with the law rather than a search after the causative factors for the divergence from the formula. We remember the slur once made upon the systematist that when a bug failed to fit into his system of classification it conveniently slipped through his fingers onto the floor and was stepped on. So there is often a tendency to blind our eyes to the truth by the comforting reflection that the fit is "fairly close," there is only a "slight" divergence from the theoretical curve or, finally, to cover a multitude of sins by that unwarranted or at least misunderstood blanket statement sometimes quoted from Brooks,[2] "When the number of cases is unlimited, the agreement is perfect,"—a formula about as well founded as the old lawyer's dictum that "a lie well told and stuck to is as good as the truth."

Daniel Starch[3] has made the assertion "that psychological and biological traits vary universally . . . in conformity with the normal, bell-shaped curve," and he even adds, "nor do we find that, on the whole, traits are distributed in a skewed manner, so that the great majority of individuals would lie either in the upper or lower range of abilities." To this formulation of the general law there can be little

[1] Wilson, Edwin B., "Empiricism and Rationalism," *Science*, 64: 51, July, 1926.
[2] Brooks, William K., *The Foundation of Zoölogy*, The Macmillan Company, New York, 1899, p. 157.
[3] Starch, Daniel, *Educational Psychology*, The Macmillan Company, New York, 1924, p. 30.

criticism except for the emphasis that disposes to ignore exceptions. When on the ground of such a law attempts are made to establish the dictum that facts should be made to conform thereto, it is about as safe a procedure as that of forcing a stick of dynamite, by means of a tamping iron and a sledge hammer, into a hole that it will not quite fit.

Professor Pearl[1] has tabulated a large number of human biological investigations showing the degree of departure from the normal curve in the distributions of variations. Out of 46 phenomena thus tabulated only 6 show significant skewness from symmetry, that is, a skewness that exceeds four times the probable error. Such data, then, tend to confirm the generalization that has been so strongly emphasized by Galton, Pearson, Cattell, Starch and others. Nevertheless, there are in Pearl's list 6 cases of unquestionably significant skewness, that is a skewness so great as to be beyond the range of chance errors and hence in all probability due to the operation of some underlying causative factor. In at least one of these phenomena, that of phagocytic ingestion of bacteria, it has been shown by the investigations of Greenwood and White[2] that the skewness is unquestionably real and must be considered in medical practice in the determination of an opsonic index. Skewness is a phenomenon, therefore, that cannot always be ignored as mere chance variation or even as due to inconsequential factors.

Dr. Rugg[3] has shown according to his own statement that in a compilation of teachers' markings which he has made "less than 10 per cent of the several hundred mark curves, representing an aggregate of over 171,400 marks, may be described as perfectly symmetrical, and not more than two or three in a hundred of all those examined have been found to be approximately 'normal.'" Comparing this assertion with the results given in Pearl's tabulation noted above, it certainly looks as though some of our educators were riding their normal curve Pegasus far beyond the limit of his endurance when they insist that teachers' marks should be made to conform to the normal probability curve.

It will do no harm, therefore, to call attention to the need of more thorough and extended investigations as to the cause of skewness in curves of distribution. It is a field in which very little more than a

[1] Pearl, Raymond, "The Significance of Biometry and Vital Statistics to the Science of Medicine," *Nelson Loose-leaf Medicine*, 7: 11–127H, p. 127C.

[2] Greenwood, M., and White, J. D. C., "A Biometric Study of Phagocytosis with Special Reference to the 'Opsonic Index,'" *Biometrika*, 6: 376–401.

[3] Rugg, Harold O., "Teachers' Marks and Marking Systems," *Educational Administration and Supervision*, 1: 117–142, 1915.

few *a priori* suggestions have been made. The writer would, therefore, offer the following contribution to this subject.

It seems possible that under certain conditions skewness might be due to the differential effect of competition. The psychological reaction to such a stimulus may be recognized as of two sorts, with various modifications according to the temperament of the individual. First, there is the stimulus to increased endeavor and greater effort, but if this fails to secure or maintain the lead, there is a reversal of the reaction, and depression ensues. This is manifest in both the business and the social worlds. It is clearly realized in athletic contests and the athlete, although aware of his trouble, sometimes finds it impossible to overcome his nervous depression. Much of the cheering on the side lines in intercollegiate games is urged on by the leaders expressly to counteract the depression of the losing side. Now it seems evident that a curve of distribution which might be of the normal probability type as the expression of a natural ability would be skewed by the operation of such a differential factor.

After some preliminary and roughly wrought investigations, of which we shall speak more fully later, it was decided that horse racing offered the best material for such a research. Anyone who has driven an old farm horse knows how often he will respond with alacrity to the stimulus of another horse passing him on the road, but as soon as out-footed he drops back again to his normal jog. Devotees of the races have often remarked that the horses themselves appear to enter into the spirit of the race and strive to win. In fact many animals seem to react naturally to the challenge of a race. The same reaction is to be observed in the chase, but the courser commonly gives up when convinced that the quarry can outrun him.

That the data might be as uniform as possible and free from complicating factors, the final material was restricted to races over a single course and of only one type. The Tijuana Race Course in Mexico was selected, as this was found to be a standard course and was one of the few that held a very long meet, 125 days of racing from November, 1925, to March, 1926. Generally races are for varying distances from about half a mile to one and a quarter miles, but the three-quarter-mile running race was selected for this study because it was apparently the standard race for mature horses and was not so long as to involve more complicating factors. The horses that take part in these races are bred to the business and, being three-year-olds or over, those that do not come up to the standards or are in any way defective have been largely eliminated. Finally, races run on days when the track was not reported "fast" were excluded. This insured that the

conditions of the races were all as nearly uniform as it was possible to render them.

With these restrictions the total number of races included in this study was 140 with an aggregate of 1,266 contestants. Some of the horses took part in more than one race. The running time of each horse was computed from the reports in "Racing-Form," a monthly publication of the racing records for "recognized North American tracks." The actual stop-watch record of the time of the winning horse is given and the distance in "lengths," "neck," or "head," by which each horse precedes the next following horse at the "finish." In computing the time of the succeeding horses, two-tenths of a second was allowed for a "length," five hundredths of a second, or half a "half-length," for a "neck," and two hundredths for a "head." This is the practice of horsemen in estimating the speed of horses. It is perhaps as close an approximation as is practicable. In the three-quarter-mile races, on the average, horses make about 10¾ feet in two-tenths, or one-fifth, of a second, the usual stop-watch unit, and it is very rare that even a winner exceeds 11 feet per two-tenths second. In all races of whatever distance or age of contestants on standard courses, the average running time ranges from about 10¼ to 10.8 feet per two-tenths second. It is evident, therefore, that in running time the "length" of a horse is estimated at about 10½ feet.

A more serious source of error is that the time of each horse, except the winner, is determined by the horseman's estimate of the "length" as viewed from the stand, and for this we must rely on the judgment of a trained and experienced expert and trust to the law of averages to reduce such errors as may occur to a minimum. At least the data are as accurate as it seems possible to obtain and are apparently not subject to any vital errors.

The data obtained from the records were tabulated and the constants computed by Pearson's method of moments,[1] the formula

$$\tfrac{1}{2}\sqrt{\beta_1}\frac{\beta_2-3}{5\beta_2-6\beta_1-9}$$

being used to compute the skewness. The range of running time was found to be from 1 minute 11 seconds for the fastest run to 1 minute 20.92 seconds for the slowest horse. It was, therefore, possible to divide the time into ten intervals of exactly one second each without introducing any appreciable error. The results obtained were for the mean time, 1 minute 15.06 seconds, median, 1 minute 14.96 seconds,

[1] Pearson, Karl, *Tables for Statisticians and Biometricians*, Cambridge, England, 1914, p. lxv.

and skewness, .1926[1] with a probable error for skewness in the fitted normal distribution of ±.0232. The skewness is, therefore, more than eight times the probable error for the normal, but a skewness of four times the error is commonly considered significant, that is, more than could be due to chance variations. It seems evident, therefore, that the distribution of the running time of horses in a race is significantly skewed toward the higher speed by some more or less constant factor.

Is this factor the reaction of the animals and, perhaps in some degree, their jockeys to the stimulus of competition? To test this question the simplest solution to suggest itself is to determine the distribution of the horses in a race with the factor of competition eliminated. How can this be accomplished? The most obvious plan is to determine the speed of a large number of horses running alone against time without observed competitors. This is impracticable from lack of reliable records; besides, the running stimulus is uncertain and probably highly variable. It seems possible to apply a better test. In each of these 140 races there was always at least one horse, the winner, upon whom the stimulus of competition, if there was such, could act as a rule in only one way. His nervous reaction must be one of exaltation or sustained endeavor. The race is too short to permit the winner to indulge in lapses of nervous response to sustained effort. It seemed possible, therefore, to eliminate the differential effect of competition while insuring high endeavor by determining the distribution of the speed of the winners alone.

To this end the time of the winners in the 140 races was tabulated as before, and a range of time records was obtained from 1 minute 11 seconds to 1 minute 16.2 seconds. It seemed possible, therefore, to divide this range into 11 intervals of a half second each without introducing any appreciable error as to skewness by extending the range one-tenth of a second at the higher speed end and two-tenths at the lower end rendering the range commensurable by 11. Doing this and computing the constants as before, a mean was obtained of 1 minute 13.67 seconds, a median of 1 minute 13.68 seconds and skewness .00016 with a probable error for the normal of ±.0698. The computed skewness was not only less than four times the probable error, it was substantially zero and the curve of distribution was essentially symmetrical. It seems, therefore, to be demonstrated that the skewing of the distribution of the speed records in these races was due to the differential stimulus of competition. Of course more conclusive proof

[1] The skewness is positive as we are measuring speed in terms of time, the greater the speed the less the time. Had the speed been measured by distance per unit of time, as feet or yards per second, the skewness would have been negative.

would be furnished if additional series of races on this course and on others were shown to yield similar results. This was not undertaken owing to the great amount of labor and time involved.

While skewness has to do with symmetry only, it was of interest to know how closely the curve approached a true normal probability distribution. Adopting the dictum of Pearson[1] that, "unless $\eta, = \beta_2 - 3$, the degree of kurtosis, be zero, subject to probable error, $.67449\sqrt{\frac{24}{N}}$; χ, the skewness, be zero, subject to probable error, $.67449\sqrt{\frac{1.5}{N}}$; d, the modal divergence, be zero, subject to probable error, $.67449\ \sigma\sqrt{\frac{1.5}{N}}$, no distribution can be legitimately described as normal or Gaussian," such tests were applied to our data with the following results; kurtosis $= -.0459 \pm .2793$, skewness $= .00016 \pm .0698$, modal divergence $= .000155 \pm .0678$. Not only are these constants well within the limits of the probable errors, but their departure from zero is in nearly every case inappreciable. The distribution is, therefore, in all respects of true normal probability type. The performances of the winning horses in such races would then appear to conform to the general law for the variability of a simple biological trait.

In the preliminary work, previously referred to, results were obtained which induced the more careful and exhaustive research with the Tijuana data as a basis. Bearing in mind the rough character of this material it will now be of interest to consider the results as indicative of tendencies. These crude and inadequate data are included with the Tijuana records in Table I. It may be noted that the distribution of speed records for all horses is significantly skewed in four out of six series of races, and the speed records for winners is not significantly skewed in any of the four series. These data, so far as they go, tend to confirm the results obtained in the more accurate work with the Tijuana records. They must serve to take the place of additional studies of the latter type.

It was of further interest to know whether other fields of competition might yield similar evidence of the influence of this stimulus. It is not easy to find material for such a study even if only for comparison. By analogy it was suggested that athletic foot races might furnish something of interest. The available material for such a study, however, was found to be far from ideal and was open to serious criticism. Human animals are not bred for the race as are horses,

[1] Pearson, Karl, "Skew Variation, a Rejoinder," *Biometrika*, 4: 169–212, 1905, p. 181.

TABLE I

DISTRIBUTION OF SPEED IN HORSE RACES

4½ Furlongs				¾ Miles				1 Mile 70 yards	
Mid-point of 1 second intervals	Frequencies			Mid-point of 1 second intervals	Frequencies			Mid-point of 1 second intervals	Frequencies
	Belmont Park	Churchill Downs	Pimlico		Churchill Downs	Jamaica	Tijuana		Churchill Downs
51.5″	6			1′—11.5″	1	10	15	1′—42.5″	1
52.5″	16			1′—12.5″	26	52	68	1′—43.5″	5
53.5″	30	5	2	1′—13.5″	57	65	209	1′—44.5″	11
54.5″	43	36	17	1′—14.5″	62	95	356	1′—45.5″	28
55.5″	34	49	53	1′—15.5″	58	51	317	1′—46.5″	28
56.5″	27	37	44	1′—16.5″	29	33	179	1′—47.5″	26
57.5″	12	18	22	1′—17.5″	19	21	76	1′—48.5″	8
58.5″	2	13	7	1′—18.5″	9	12	36	1′—49.5″	12
59.5″	2	5	1	1′—19.5″	6	4	7	1′—50.5″	8
60.5″	1	5		1′—20.5″	2	1	3	1′—51.5″	2
61.5″		2		1′—21.5″	2	3		1′—52.5″	
				1′—22.5″	3	3		1′—53.5″	1
				1′—23.5″		1			
No. of horses	173	170	146		274	351	1256		130
No. of races	15	17	17		26	46	140		16
Mean time	54.89″	56.22″	56.13″		1′—15.15″	1′—14.8″	1′—15.06″		1′—46.9″
Median time	54.80″	55.90″	56.02″		1′—14.85″	1′—14.5″	1′—14.96″		1′—46.7″
Coefficient of variation	3.06%	2.96%	1.97%		2.61%	2.72%	1.98%		1.83%
Skewness	.155	.806	.192		.623	.434	.193		.312
P. E. for normal	±.063	±.063	±.068		±.050	±.044	±.023		±.072

TABLE II

DISTRIBUTION OF WINNING SPEED IN THREE-QUARTER-MILE HORSE RACES

Mid-point of 1 second intervals	Frequencies					Mid-point of .5 second intervals	Tijuana
	Belmont Park	Jamaica	Coney Island	Hawthorne	Tijuana		
1′—10.5″	1		3	1		1′—11.15″	1
1′—11.5″	8	10	17	6	6	1′—11.65″	5
1′—12.5″	11	15	31	24	23	1′—12.15″	7
1′—13.5″	5	13	15	31	55	1′—12.65″	16
1′—14.5″	2	3	2	11	43	1′—13.15″	23
1′—15.5″		1		2	11	1′—13.65″	32
1′—16.5″					2	1′—14.15″	25
						1′—14.65″	18
						1′—15.15″	7
						1′—15.65″	4
						1′—16.15″	2
No. of horses	27	42	68	75	140		140
Mean time	1′—12.46″	1′—12.79″	1′—12.44″	1′—13.18″	1′—13.76″		1′—13.67″
Median time	1′—12.41″	1′—12.73″	1′—12.45″	1′—13.21″	1′—13.75″		1′—13.68″
Coefficient of variation	1.33%	1.35%	1.20%	1.30%	1.32%		2.64%
Skewness	.242	.352	.013	.028	.0098		.00016
P. E. for normal	±.159	±.127	±.100	±.095	±.0698		±.0698

nor are there as strict standards for admission to the track. This, as we shall see, is reflected in the greater variability as measured by the coefficient of variation. Athletic races are not run over the same course day after day so as to give a large series of records under uniform conditions of environment and effort. Most serious of all, the time is not recorded except for the winner and occasionally for two or three of his immediate followers. There is scarcely a race in which the running time of every contestant can be obtained even approximately. For such material as I have been able to obtain I am indebted to Mr. James A. Taylor, Assistant to the President of the Intercollegiate Association of Amateur Athletes of America, and the data here used are taken from the Official Handbook of the Association for 1925–26.

The only runs for which we have the scores of every contestant are some of the cross-country runs. For our purpose the records of the Sixteenth and Seventeenth Annual 'Varsity Cross-country runs and the Fifth and Sixth Annual Freshman Cross-country runs for the I. C. A. A. A. championship meets in 1924 and 1925 were selected. All of these runs were over the same course at Van Cortlandt Park, New York City; the "'Varsity" runs being for six miles and the Freshman runs for three miles. This was the nearest to uniformity that could be obtained, as cross-country runs vary so greatly as to distance, topography of ground and other environmental conditions that comparison is impossible. These races are open to practically all comers and in other ways involve so many complicating factors that they are of little value for critical analysis, but the data, as the best that can be obtained, may be suggestive in the light of the events previously studied.

Care was taken to select the intervals in tabulation to avoid any pseudo-skewness, that is, an interval was chosen as nearly commensurable with the range of the distribution as possible and so adjusted that any overlapping at one end was counter-balanced by an equal overlap at the other. The results are shown in Table III. It will be noted by comparison with other tables that the coefficient of variation is large as would be expected from the lack of any very exacting rules of qualification for admission to these races and the fact that institutions may enter as many representatives as they wish, the five making the best score being counted on points, but all serving to determine the score of their competitors. The race is, therefore, to a considerable degree a free-for-all medley, but the method of scoring renders it necessary to record the place of each contestant. As this is usually done by timing, it makes it possible for us to obtain a close approximation to the running time of each man, the only athletic race in

TABLE III

DISTRIBUTION OF TIME IN I. C. A. A. A. A. CHAMPIONSHIP CROSS-COUNTRY RUNS, 1924–25

	17th 'Varsity		16th 'Varsity		6th Freshman		5th Freshman	
	Mid-point 52 secs. intervals	F	Mid-point 53 secs. intervals	F	Mid-point 30 secs. intervals	F	Mid-point 31 secs. intervals	F
	31′—00″	5	31′—49.5″	10	15′—20″	6	17′—44.5″	10
	31′—52″	17	32′—42.5″	18	15′—50″	9	18′—15.5″	16
	32′—44″	25	33′—35.5″	22	16′—20″	18	18′—46.5″	17
	33′—36″	25	34′—28.5″	16	16′—50″	21	19′—17.5″	14
	34′—28″	22	35′—21.5″	16	17′—20″	10	19′—48.5″	9
	35′—20″	6	36′—14.5″	7	17′—50″	5	20′—19.5″	4
	36′—12″	1	37′—07.5″	4	18′—20″	4	20′—50.5″	3
	37′—04″	6	38′—00.5″	1	18′—50″	2	21′—21.5″	9
			38′—53.5″	3				
No. of contestants	107		97		75		82	
Mean time	33′—29.68″		34′—13.74″		16′—44.40″		19′—11.07″	
Median time	33′—23.52″		34′—58.39″		16′—41.43″		18′—58.35″	
Coefficient of variation	4.24%		4.88%		4.92%		5.80%	
Skewness	.369		.537		.532		2.157	
P. E. for normal	±.080		±.084		±.095		±.091	

which we are able to do this. It is to be observed that the distribution of the contestants is highly skewed, the crest of the wave being advanced toward the higher speed record as in horse races, and in all cases more than four times the probable error for the normal curve.

A comparison of winners is impossible owing to lack of material. As a substitute an attempt was made to study the distribution of winners of various races in the intercollegiate local meets. As these runs are usually over specially graded tracks, it seemed possible to combine the records of different meets under fairly uniform conditions. The Official Handbook, above mentioned, furnished the complete records of all events in about 120 such meets held in the year 1925. Here apparently was an excellent body of reliable data. And so it was as far as the accuracy of the records was concerned, but on examining the material it was found to be very heterogeneous, for, while many were clearly "'Varsity" meets, some were of "Freshman" classes and others were meets with secondary schools and yet others were between small institutions in which it was very evident that events were sometimes won with very low scores. No basis of elimination could be devised that did not render the process too obviously one of selection; besides, the attempt to remove the weaker meets from consideration seriously cut down the available number of records, already none too large for statistical use. It was decided to take them as they came trusting that at least rough indications might be obtained of the trend. The simple runs of 100, 220, 440, and 880 yards and the one-mile and two-mile races were selected for study and the actual recorded time of the winners was tabulated by intervals adjusted as before for commensurability. Table IV gives the results for this work.

Again we observe a high coefficient of variation, doubtless a reflection of the heterogeneous character of these meets. With the exception of the long runs, skewness is relatively small, in only one case approaching significance from the normal curve. The probable error, however, is high and with the large variability in the data we would not claim these results to be more than suggestive. It has already been intimated that teachers' marks, as a measure of the relative progress of students in their school work, are prevailingly skewed in their distribution with the mode toward the higher end of the scale. We have here essentially similar conditions for the operation of the factor of competition, as in our race studies, with a like result. The writer expects to treat this subject more completely in another paper.

From these investigations, imperfect though they be, the conviction seems justified that distributions of measures of progress or success when such progress is subject to the factor of competition, interest

TABLE IV

DISTRIBUTION OF WINNING TIME IN INTERCOLLEGIATE FOOT-RACES, 1925

100 yards		220 yards		440 yards		880 yards		1 mile		2 miles	
Mid-point .2 secs. intervals	F	Mid-point .6 secs. intervals	F	Mid-point .5 secs. intervals	F	Mid-point 3 secs. intervals	F	Mid-point 6 secs. intervals	F	Mid-point 13 secs. intervals	F
9.7″	8	21.0″	4	48.65″	5	1′—54.5″	10	4′—23″	5	9′—31.5″	4
9.9″	24	21.6″	21	49.15″	7	1′—57.5″	20	4′—29″	27	9′—44.5″	16
10.1″	31	22.2″	33	49.65″	3	2′—00.5″	30	4′—35″	32	9′—57.5″	27
10.3″	35	22.8″	27	50.15″	11	2′—03.5″	30	4′—41″	28	10′—10.5″	22
10.5″	9	23.4″	20	50.65″	8	2′—06.5″	18	4′—47″	11	10′—23.5″	9
10.7″	4	24.0″	7	51.15″	21	2′—09.5″	4	4′—53″	9	10′—36.5″	13
10.9″	1	24.6″	3	51.65″	11	2′—12.5″	4	4′—59″	2	10′—49.5″	6
				52.15″	15	2′—15.5″	1	5′—05″	0	11′—02.5″	0
				52.65″	8			5′—11″	1	11′—15.5″	1
				53.15″	7						
				53.65″	0						
				54.15″	10						
				54.65″	5						
				55.15″	2						
				55.65″	4						
No. of contestants....	112	115		117		117		115		98	
Mean time.....	10.152″	22.57″		51.78″		2′—02.01″		4′—37.82″		10′—08.77″	
Median time.....	10.155″	22.49″		51.56″		2′—01.85″		4′—36.78″		10′—05.18″	
Coefficient of variation	2.43%	3.60%		3.39%		3.65%		3.14%		3.51%	
Skewness.....	.143	.268		.300		.233		.418		.489	
P. E. for normal.....	±.078	±.077		±.076		±.076		±.077		±.083	

or ambition, tend to have the mode skewed from the normal curve of innate ability toward the end to be attained. Since it may be assumed as an axiom that no one can do better than his best, or, in other words, that one cannot do more than he has the inherent ability to do, it seems evident that the skew curve of the distribution of measures of accomplishment under the stress of competition is a demonstration that few individuals either of men or beasts fully use the ability with which they are naturally endowed. However, working continuously at such high level of efficiency tends to wreck the biological machine.

TWO METHODS OF FORECASTING HOG PRICES

By Mordecai Ezekiel, *Bureau of Agricultural Economics, United States Department of Agriculture*

Forecasts as to price changes cannot fail to be wrong occasionally; yet it is better to make definite statements which are wrong one time out of four than to make statements which are never wrong—but which are likewise never right, because they do not say anything definitely.

If coming changes in the supply of and demand for any product are regularly and definitely foreshadowed by preceding changes in cost goods, speculative stocks, and other "forecasters," it should be possible by using the necessary "lags" to make a definite objective measurement of just exactly what these relationships are, and then apply these relations to the values of the indicators at any time to determine the most probable price for stated times in the future.

Stated more simply: If coming events *do* "cast their shadows before," all that is necessary is to determine the relation between the length of the shadow and the event, apply that same correction to the present "shadows"—and there is your forecasted event.

In the past year the Bureau of Agricultural Economics has made forecasts of hog prices by two different methods. One forecast was published, the other was not. It is now possible to examine how well these two methods worked in this particular case, and to discuss their respective advantages and disadvantages.

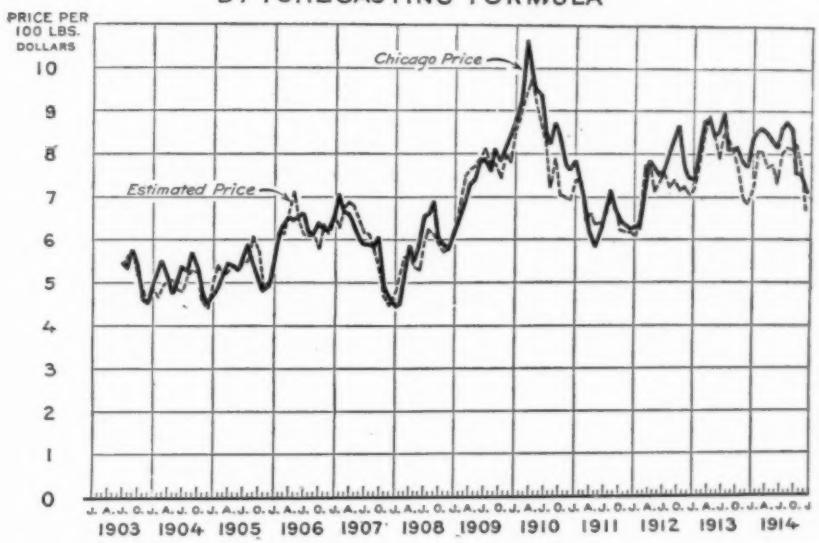
The two methods may be designated the "empirical formula" method and the "demand-curve" method. The first method employs a formula which is based on empirical measurement of the relation between changes in various forecasting factors and subsequent changes in price. Applying fixed lags to current data, the formula indicates future changes in prices on the assumption that the influence of each factor will be just the same as it has averaged in past years. Since the factors involved and the influence of each at different times are never exactly the same, there is nearly always some difference between the actual prices and those estimated on the basis of this unvarying relationship. (Note Chart I.)

Editor's Note.—This paper was received in the editorial office of this Journal in mid-September. The author wished definitely to commit himself in his forecasts in advance of actual occurrences.

Author's Note.—The actual prices for the first six months were as follows: July, $13.02; August, $12.12; September, $12.66; October, $13.18; November, $12.00; December, $11.65. These prices are comparable with the prices forecasted.

CHART I

ACTUAL HOG PRICES AND HOG PRICES ESTIMATED BY FORECASTING FORMULA



The forecasts shown on this chart were computed by an empirical formula using data lagged six months or more. Since the computations were made recently, they are really estimates instead of forecasts.

The demand-curve method depends, essentially, upon determining (a) the past relation between supplies placed on the market and prices received, and (b) the effect of changes in other demand factors upon this relation. Knowing the curve of supply-and-market-price, it is then possible to apply estimates of supply to the curve, make corrections for other variables, and so obtain an estimated price. The relations discovered by the statistical analysis may be expressed in a definite formula as Working has done for potatoes and Killough for oats, or they may be used in a less-rigid synthetic process, as described later in this paper for hogs. This synthetic use of the demand-curve method does not rely on a fixed formula, but takes account of all new or unusual factors as soon as they can be recognized. It attempts to evaluate each factor in the light of its probable influence on the situation at the moment, and therefore allows of the introduction of new material which could not be used by the fixed or average formula method.

Correlation and multiple correlation analysis has been the method most used for constructing formulae in the past. The work of Working on potatoes, of Wallace, Haas, and Sarle on hogs, of Killough on oats,

and of Bradford Smith on cotton, has served to break the ground and develop a few of the technical problems involved in this approach.

Haas' studies of hog prices for the period 1904 to 1914, following those by Wallace, with additional factors added, yielded a regression equation by which hog price changes could be forecast for six months ahead, with a correlation of .85 in terms of deviations from trend corrected seasonally, and a standard error of but 49.5 cents.[1] (Note Chart I.) This formula was of the "empirical formula" type.

Application of this formula to post-war conditions was delayed because of the necessity of determining the trend to be assumed for hog prices. The pre-war trend was a composite measure of the changing balance between price-level, hog production, population growth, and per capita demand for hog products, foreign demand for pork and lard, prices and supplies of alternative meats, and so on. The factors explicitly included in the formula—the weight of hogs, the price of corn, the corn-hog price ratio (or rather, a function of it computed by subtracting the price of 11.4 bushels of corn from that of 100 pounds of hogs) and the prices of industrial stocks—are factors indicating primarily periodic changes in hog production and in domestic demand. It is rather remarkable that a single straight line should have served to measure the composite effect of the other factors mentioned sufficiently well to give the agreement shown.

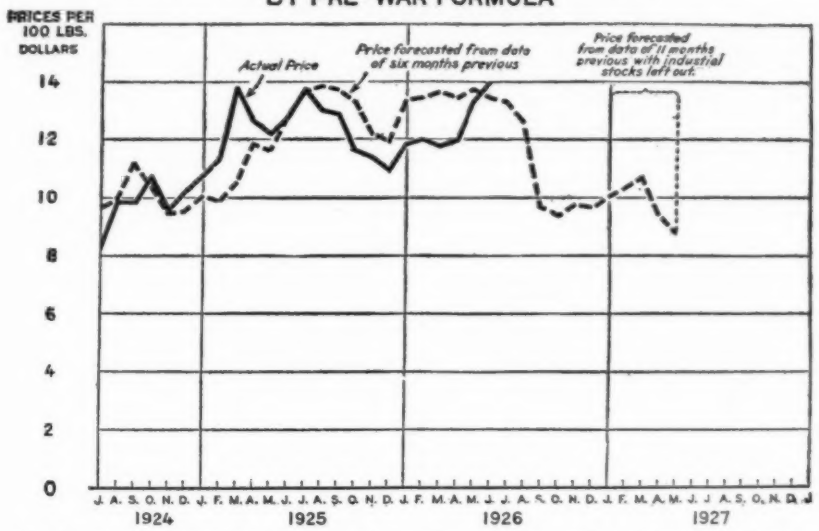
Determination of even an approximate post-war trend is rendered difficult by the relatively short period available. With a succession of good corn crops there has been only one complete "corn-hog cycle" since 1920; we are now about one-quarter through a second one. In addition, the very unstable demand conditions in America from 1920 through 1922, and in Europe to date, have made individual study of the different elements bearing on trend unproductive. For the present, therefore, a "flat" trend has been assumed, primarily on the basis of a substantially constant general price level from 1923 to 1926. The height of this trend was determined so as to give the best agreement between actual and estimated prices during the period July, 1924, through June, 1925—which may or may not prove to be a period of "normal" relationships.

Applying the pre-war formula to current data, and using this level trend, gave the *estimates* for the period July, 1924, to June, 1925, and the *forecasts* for the second half of 1925 and for 1926, shown in Chart II. (The "*estimates*" were computed after the event, as were all the pre-

[1] G. C. Haas, and Mordecai Ezekiel, "What Makes the Price of Hogs," U. S. Department of Agriculture, Bureau of Agricultural Economics, Preliminary Report, March, 1925; and "Factors Affecting the Price of Hogs," U. S. Department of Agriculture Bulletin 1440, 1926.

CHART II

HOG PRICES, 1924-1926, AND PRICES FORECASTED BY PRE-WAR FORMULA


PRICES PER 100 LBS. DOLLARS
14
12
10
8
6
4
2
0
Actual Price
Price forecasted from data of six months previous
Price forecasted from data of 11 months previous with industrial stocks left out.
J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J
1924
1925
1926
1927

The forecasts shown here were made by the same formula as those of Chart I. Beginning with July 1, 1925, they are actual forecasts computed in advance.

war estimates; while the "*forecasts*" were computed before the event.) The deviation of actual prices from estimated is, on the average, much larger for the post-war years than for the pre-war study. In addition, both the price advance estimated for the first half of 1925, and the decline forecasted for the second half, actually took place several months earlier than would have been true had they followed the usual course under similar conditions, as indicated by the forecast line in Chart II. This same relation between actual and estimated prices, however, was true several times before 1914, notably on the price declines in 1905, 1907 and 1914, and on the advances in 1906–07 and 1912–13. It would appear that definite formulae with fixed lags cannot always hit the exact month of price advance or of price decline. Yet for the year 1925 the average difference between the actual average price each month and the prices estimated or forecasted was only about 50 cents, or 4 per cent on the prevailing level.

The market for hogs is not now exactly the same in all respects as it was before the war. The development of pig surveys by the Department of Agriculture, by which reports from a wide sample of farmers indicate not only how many pigs and hogs are on farms, but what changes will probably occur in the size of the next crop of hogs, gives

"the market" much better insight into future changes in supplies than it had during the period from whose data this formula was computed. It is possible that this new information may have changed the rapidity or extent of price reactions.

This advance information on supplies indicates that it is unlikely that the sharp drop in hog prices which the formula forecasts for the fall of 1926 will occur before the spring of 1927. The surveys indicate that supplies of hogs will be no heavier this summer than last; whereas had farmers reacted to the favorable hog prices of last fall as they have usually done, there would have been an increased crop of pigs this spring, heavy marketings this fall, and the declining prices indicated by the mathematical forecast. It is the type of information given by these pig surveys which can be included in what have been designated as "synthetic demand-curve forecasts," whereas the empirical formula method, applied directly, cannot take supplementary information into consideration.

Twelve months ago a forecast was made of hog prices for the next year by the synthetic method. The forecasted price was obtained by setting over against a supply-price curve for hogs the expected supplies during the summer run of 1925 and the winter and spring run of 1925–26 (considering also provisions in cold storage), applying the usual monthly changes in price, and then adjusting for the expected effect of business conditions. The elasticity of the supply-price curve was obtained from the study of pre-war relations previously mentioned, while its height was determined by the relation of supplies and prices during the preceding twelve months. The limits within which the forecast was stated were purely empirical, as no previous work of exactly this type had been done. They were made somewhat larger than the pre-war standard error of the empirical formula forecast; subsequent experience showed that even that was not wide enough.

Comparing the forecasted prices from July, 1925, to June, 1926, with the actual prices shown on the same chart (Chart III), it is seen that for the period from August to December the forecast missed by a considerable margin, the actual price running $2.50 to $3.50 below the lower limits of the forecast—an error of about 20 per cent. Thereafter the two lines began to draw together, though separating in March and April; while in May and June of 1926 the actual price fell within the range forecasted nearly a year earlier.

Three factors seem to be responsible for most of the difference between the actual and forecasted prices. These are (1) failure to forecast properly the receipts for the summer of 1925, (2) the good corn crop of 1925, which could not be foretold accurately at the time the

price forecast was made; and (3) the fact that demand for hog products through the fall and winter of 1925–26 was not quite so strong as had been expected, due partly to the large crop of cotton and low price of cottonseed oil the fall of 1925, with accompanying weakness in lard prices.

From July through October, 1925, hog receipts at all markets were 21 per cent below those of 1924, while at the time the forecast was made it was expected that they would be 40 to 45 per cent below.[1] The fact that receipts were one-third larger than expected was apparently why prices in the late summer and fall of 1925 were one-fifth lower than forecasted. The relation is quite in keeping with the 1.6 elasticity of demand for hogs.[2]

The corn crop in 1925 was nearly three billion bushels, and with low prices for corn and relatively high prices for hogs through the whole winter and spring, the average weight of hogs slaughtered from November through May increased 17 pounds over weights a year earlier, when corn was scarce and high.

Receipts of hogs in November were one-quarter lower than a year earlier, but the general expectation of heavier receipts later on tended to decrease prices in spite of the current low receipts. With receipts in December declining to one-third below those of the previous year, prices began to recover, and with continued low receipts prices remained fairly stable through the rest of the winter.

As compared with the previous year relatively fewer hogs were marketed in the fall and early winter of 1925 and relatively more were marketed in the late winter, preventing the usual seasonal rise from December to March indicated by the forecast. This was the result of

[1] The error in this forecast was due to a misinterpretation of the pig survey questionnaire by farmers. The items at fault were stated as follows:

"*Fall Farrowing This Year, 1924*

"4. Number of SOWS which farrowed (gave birth to pigs) on your farm during the *last 6 months* (between June 1 and December 1, 1924) ..... ———

"5. Total number of PIGS SAVED out of all litters farrowed on your farm during the *last 6 months* (June 1 to December 1, 1924)..... ———

"*Fall Farrowing Last Year, 1924*

"6. Number of SOWS which farrowed on your farm during the *6 months* between June 1, 1923, and December 1, 1923..... ———"

Careful study of the individual reports showed that many farmers had reported the number of pigs born in 1923 when the number of sows farrowed in 1923 should have been reported. The most glaring cases of this kind had been eliminated in editing the reports, but apparently enough of the border-line cases were left in to swell the number of sows farrowing in 1923, and therefore to exaggerate the decrease in sows farrowing from 1923 to 1924 when the 1923 figures were used as the basis, and so result in an under-estimate of the fall crop.

In subsequent surveys both the sows farrowing and pigs saved have been asked for the previous year as well as the current year, thus apparently preventing a repetition of such a general error by the farmers in filling out the report.

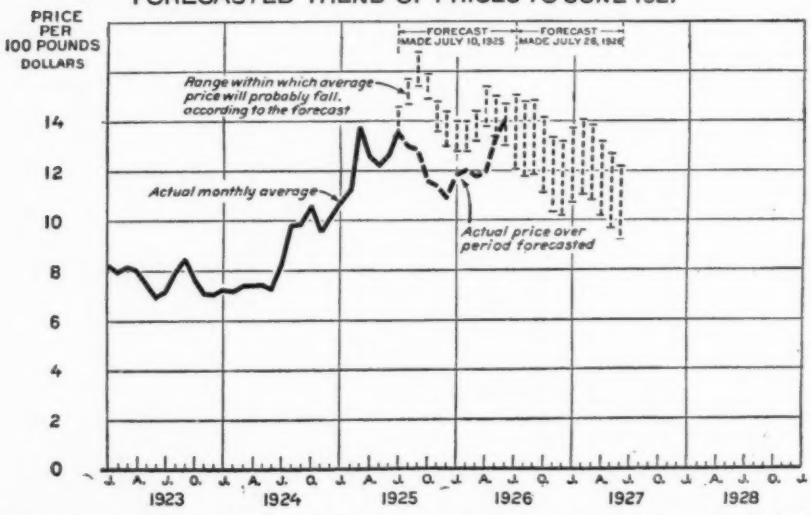
[2] U. S. Department of Agriculture Bulletin No. 1440, *loc. cit.* p. 37.

the corn situation, which favored delaying marketings in order to feed to heavier weights.

The failure of the synthetic forecast through the mid-summer and fall can thus be explained as due not to any inherent fault in the method, but to an erroneous forecast of market supplies. For the winter and early spring, however, this same factor does not suffice—the difference then is partly due to factors such as the cotton-seed crop, the corn crop, and foreign developments, which were not represented in the factors included in the forecast. This illustrates one of the inherent weaknesses of the synthetic method. Where one forecast (as in this case future supplies) is used as the basis of the price forecast, the possibility of error in the first forecast introduces an additional uncertainty into the forecast of price. The formula method, by contrast, employs only definitely known factors—except the trend.

CHART III

MONTHLY PRICES OF HEAVY HOGS AT CHICAGO, JAN. 1923 TO JULY 1926
AND
FORECASTED TREND OF PRICES TO JUNE 1927



The forecasts shown here were made by the "synthetic demand-curve" method instead of an empirical formula. As shown by the dates, they are all true forecasts.

With the guide of this initial experience, a similar synthetic forecast (also shown in Chart III) has been computed for the next twelve months. A wider range of factors has been considered in estimating market receipts for the summer, and it is believed that on this basic factor, at least, the large error of last year will not be repeated. At the same time the range of the forecast has been widened in recognition of

the fact that changes in many of the forces which may bear on the price, particularly for a given month, cannot be forecasted, and that therefore the range must be sufficient to allow for the effects of such influences.

It is possible that eventually the most satisfactory results in price forecasting may be obtained by some combination of the "empirical formula" and the "synthetic" methods. This would involve using a fixed formula as the basis of departure, and then modifying the mathematical results in the light of specific current conditions. As Sarle has suggested,[1] examination of the periods of marked deviation by a formula forecast from the actual price may be of great assistance in working out corrections to be applied to subsequent forecasts under specific combinations of circumstances.

One advantage of the synthetic or demand-curve method is undisputed. It can be used to forecast prices whenever available or future supplies can be estimated or forecasted by any other means—crops estimates, surveys of producers, sample studies, etc. On the other hand, empirical formulae of the type used in Haas' hog study can be applied only when measurable factors—such as in this case the current relation of corn prices to hog prices—serve as indicators of future changes in supplies.

It is quite evident from experience to date that statistical formulae have not given in actual forecasting as high correlation as in explaining past periods. At the same time examination of trade papers[2] indicates that non-statistical "market judgments" are even less reliable than available statistical forecasts. As more and more experience is gained with actual forecasting from statistical studies, the practical results should be pushed ever closer to those theoretically possible.

We have then two forecasts of hog price changes for the next year. The definite formula forecast (Chart II) has been the most accurate in the past year (1925). On the other hand, it is believed that it does not sufficiently represent all of the present conditions. "Hog production as shown by the pig surveys reached the low point of the cycle with the spring pig crop of 1926, and increased farrowings next fall are indicated. Market supplies through this summer, fall, and winter will continue as low, if not lower, than a year earlier and not until next spring can increased market supplies be expected . . . it seems likely that hog prices this summer and fall will be maintained at about the levels of last year."[3] It therefore seems likely that during the next

[1] C. F. Sarle, "Forecasting the Price of Hogs," *American Economic Review*, Vol. 15, No. 3, Sup. No. 2, September, 1925.

[2] Citations to price and market forecasts in standard trade journals, and comparisons with subsequent price changes, can be secured from the author.

[3] U. S. Department of Agriculture, Bureau of Agricultural Economics, *Hog Outlook Report*, July 17, 1926.

twelve months hog prices will agree more closely with the forecast of Chart III, based on a synthetic evaluation of the most significant factors, than with the forecast of Chart II, which shows what would have been the normal sequence of events "before the War."

FURTHER STUDIES IN THE GRAPHIC USE OF CIRCLES AND BARS

I

A DISCUSSION OF THE EELLS' EXPERIMENT[1]

By R. von Huhn, *Washington, D. C.*

Mr. Walter Crosby Eells, in his paper entitled "The Relative Merits of Circles and Bars for Representing Component Parts," has subjected the method of graphic presentation by circles or bars to some interesting quantitative tests, upon which results Mr. Eells comes to definite conclusions which are stated on page 132, June, 1926, issue of this Journal. From the experimental evidence within the limits of the test, the conclusions drawn can be regarded as significant, since to my knowledge no other similar experiments have been published. However, I feel that the experiment was limited from the very start by the one-sided treatment of its setting, and for this reason the calculations and the conclusions based upon the quantitative evidence, while correct within limits of the test, might have yielded very different results had the experiment dealt with different phases of applications of bar as well as circle.

(1) *Absence of scale in experiment*

In the experiments carried out on the basis of test sheets submitted to the students, no scale was shown in connection with the bars or circles. It is evident that the presence of such a scale greatly facilitates accuracy of judgment as to the magnitude of the several segments, especially of the first segment to the right of zero, and in the case of a diagram of percentage distribution, the segment to the left of the 100 mark. Whenever bar charts are shown in practical graphic presentation, it is customary to have a reference scale either in percentage or absolute units (see Charts I and II). Now the use of the horizontal scale in connection with a bar is much more effective than a circular percentage scale is for a circle. In case of the bar, the motion of vision of the scale and of the component parts is straight horizontal and starts from the zero point, moving usually toward the right. However, in the case where component parts are shown in a circle, the motion of

[1] The author is indebted to Dr. Dana E. Durand, Chief of the Statistical Research Division of the Bureau of Foreign and Domestic Commerce for reading the manuscript and for many helpful suggestions.

vision of the parts and of the scale begins at an arbitrary zero on the circumference of the circle, usually from the "North Pole," to use a geographic term, and takes its path in clockwise rotation. The circular path which the eye must follow is an additional effort in viewing this type of diagram. The effort becomes more pronounced when a series of circles are to be compared with each other (see Charts III and IV). In the case of the bars, the path of vision is one dimensional, in the case of the circle, the rotary motion of the path of vision involves a two dimensional feature. The horizontal scale when used in connection with a series of bars and their component parts expressed in percentage distribution permits a much easier reading than in the case of circles.

(2) *Absence of labels of the sectors in the experiment*

Another important item to be considered is the fact that in actual practice where a distribution of component parts is to be shown, the various sections have to carry labels, and hence in judging the relative magnitudes of the component parts, this technical detail of presentation adds another consideration as to the choice between the bars and the circles. The placing of legends within or above or below bars is by far easier than in the case of circles where the location of legends within or near the sectors frequently causes optical illusion. Charts I and II show plainly the convenient way in which all labels can be accommodated when using bar representation unless the number of component parts is too large. When a single universe consisting of a large number of parts is to be shown, and especially when the component parts are both to be shown separately and to be combined into groups having a certain attribute in common, circle presentation offers a certain advantage with respect to the placing of labels. If the diameter of the circle is made large enough, the sector representing the smallest component part may become wide enough to accommodate the label either inside the sector or outside on the perimeter of the circle. The labeling of the groups of sectors is facilitated by adding an external concentric circle and extending the two radii, which represent the range of the group, placing the group label on a circular dimension line which connects the two extended radii.

(3) *Absence of comparisons*

In the experiment of the author, the circles are unrelated to each other. For many purposes of graphic analysis it is highly desirable to compare distributions, especially in time series in order to show tendencies of growth or decline of the several components. For such comparison, the bar presentation has distinct and great advantages:

(a) In the first place a common scale is running through all compared

bars, a feature which of course cannot be secured in the case of different circles (see Charts I and II);

(b) The question of labeling the components is more easily and satisfactorily solved in the bar presentation; ordinarily only one of the bars needs to be labeled. This is because:

(c) The symbols which represent the different components of the distribution are tied together and less optical effort is required to follow them, a further advantage *per se;*

(d) Still more important is the fact that possible trends of the component parts can be seen easier at a single glance in the bar presentation, whereas the eye must laboriously pass from one to the other circle when applying the circle presentation. For example, the percentage variation of the item "Residential" in the case of Charts I and II, although slight, can be seen at once, whereas in Chart III this slight variation of the same item is not evident, in fact all three distributions in Chart III look almost static. It should be noted especially that where we deal with a series of bars, the first component part of all the bars presents itself to the reader as starting from the common zero point, and in the case of percentage distributions the last component part has as common reference line the 100 per cent line of the scale, reading from right to left. This feature makes it possible to select at least two component parts for special trend comparison. By placing two major component parts on the extreme sides of the grid, the balance of the space left is then occupied by the minor component parts. If there is a definite trend in the two major components, the lateral displacement of the other components is systematic and the difficulty of comparing even these with one another is reduced to minimum limits. The circular nature of the displacement of the segments in circles increases greatly the difficulty of comparing the intermediate segments as easily as in the consecutive manner in which the bar diagram presents it. While such bar comparisons of per cent distributions are particularly effective in time series showing a trend, a similar convenience can often be secured in comparisons of the component parts of different universes (industries, areas, etc.) for a single time. The universes can be arranged in the order of the relative magnitude of one of the major component parts, whereupon it will often appear that there is some systematic principle in the distribution of the other components as well.

(4) *The use of bars and circles for absolute figures*

The tests conducted by Mr. Eells were all made with circles which had the same diameter. In other words, all that was shown was the relative importance of the components. But often it is desirable to

compare the absolute magnitude of several totals as well as to show component parts. In comparing absolute figures by means of circles, it is customary to reduce the values to be shown to area units by taking the square roots of the values as the diameters of the circles. The differences in the circles are area differences as compared with linear differences when using the bar. Naturally, it is much more difficult to compare areas than lengths. For example, Chart II shows the "Value of Construction Contracts in 36 States by Principal Classes, 1923–25." This particular application of graphic representation, brings out not only the relative distribution of the items "Residential," "Commercial," etc., but also the absolute magnitudes of the total values for the years shown, as well as the absolute values of their respective component parts. Now let us compare Chart II with Chart IV. In the first place, comparing the totals of 1923 and 1924 in Chart II, we can judge at once that the actual increase from 1923 to 1924 amounted to about 500 million dollars. How easy this is read in the case of the bar presentation. Inspection of Chart IV which shows the same data in form of circles makes the fact that there was some increase in 1924 over 1923 visible by its slightly increased area, but it is quite impossible to determine the amount of the increase. It should not be forgotten that to make actual comparison between two circles of different areas, they must be mentally subtracted from each other which leaves for comparison of growth or decline a *ring*. Naturally, it takes more than a skillful observer to arrive at once at the percentage of difference in viewing the circles, not to speak of converting the ring area back into the actual increase or decrease in terms of dollars or other units. It would be interesting to set up a number of experiments on this basis, and I think the prediction that the circle presentation would fall far behind the bar presentation can be safely made.

(5) *Comparison of absolute magnitude of sectors*

In comparing the absolute magnitude of sectors of circles of different sizes, still greater difficulties are experienced than in comparing the circles as a whole. Indeed in such cases circles virtually serve only to indicate per cent distribution, and they are less effective for that purpose than where the circles are all of the same size, because only the angles can be compared and not the arcs, chords, or areas. All the objections which apply to the use of circles for per cent distribution also apply where the circles show absolute magnitudes. If we glance again at the bar Chart II, the analysis of the change in the component parts presents no optical difficulties. Even the lateral displacement which takes place does not interfere with the graphic analysis to such an extent that the visualization would be termed a process of decipher-

CHART I

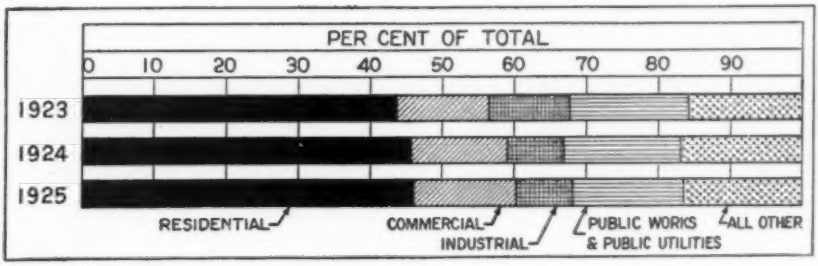


CHART II

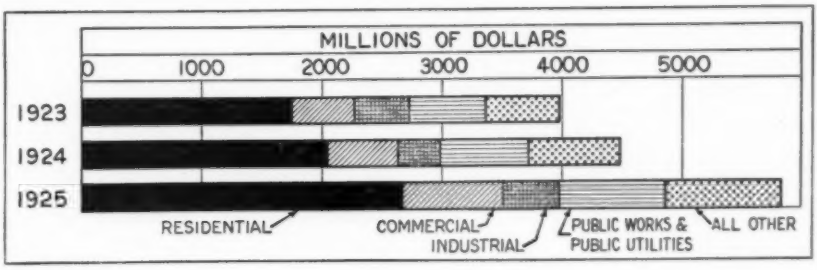


CHART III

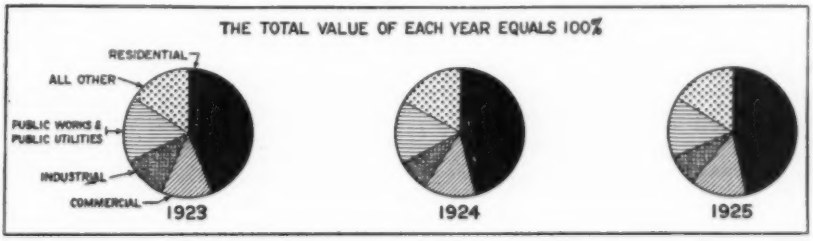
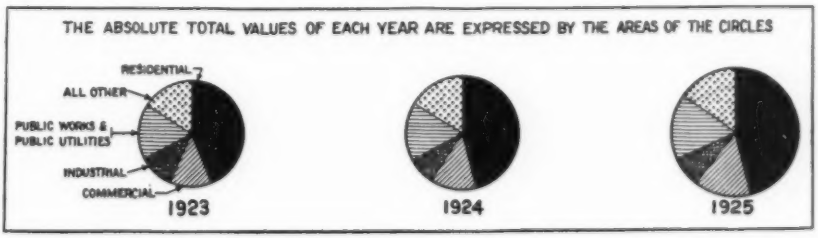


CHART IV



ing. Another interesting comparison can be made in Chart II which does not present itself at all to the eye in Chart IV. If we compare the total length of the bar for 1923, representing 3,981 millions of dollars, with 1925, we see at once that almost the same amount, namely 3,970 millions of dollars, in 1925 was taken up by the three component parts, "Residential," "Commercial," and "Industrial," alone. Such points as this have been entirely overlooked in the setting of the experiments and I venture to say cannot be discovered by the circle method.

In conclusion, it seems that the only case where the circle may be preferable to the bar is where a *single total* with rather numerous component parts is to be shown, and where the parts need to be presented not only singly but also in groups. To accept Mr. Eell's quantitative results as conclusive evidence in the question of circle against bar presentation, would result in a grave injustice to our friend the bar, and only further experiments where such points as the ones mentioned in this paper are made a feature of the experimental setting will bring out the fact whether or not the bar presentation remains the ultimate victor.

II

SOME ADDITIONAL DATA

By Frederick E. Croxton, *Columbia University*

Professor Eells, in his article in the June issue of this Journal on the bar chart and circle diagram as means of presenting statistical data, frankly recognizes that his results are at variance with general opinion of the relative merits of these forms of graphs. About six years ago the writer had occasion to make a study of the accuracy of judgment when based upon various forms of graphic presentation. One phase of this study was concerned with component part bar charts and pie or circle diagrams. These results, while not conclusive, are presented for comparison with those of Professor Eells.

Two sets of charts were used in this experiment. One set (Chart I and II) depicted the ratio 1:1½ and the other (Charts III and IV) the ratio 1:4. The order of presenting these diagrams to the observers was Chart II, Chart III, Chart I, and Chart IV. No scales were used on the charts.

CHART I
(A : B : : 1 ; 1½)

CHART III
(A : B : : 1 : 4)

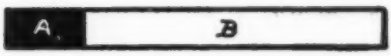


CHART II
(A : B : : 1 : 1½)

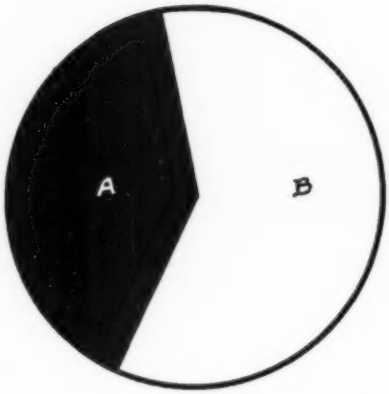
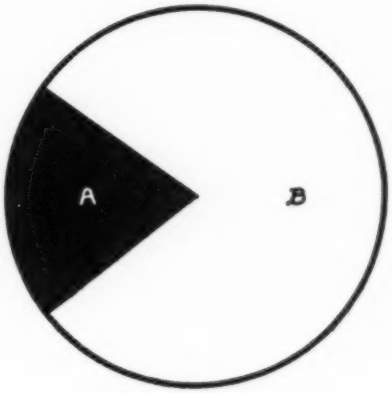


CHART IV
(A : B : : 1 : 4)



Results of set showing ratio 1:1$^{1}/_{2}$

Table I shows the frequency distribution of the estimations made by 287 observers concerning the ratios shown by Charts I and II.

TABLE I
ESTIMATES OF RATIOS SHOWN BY CHARTS I AND II

A is to B as 1 is to	Chart I Bar chart	Chart II Pie diagram	A is to B as 1 is to	Chart I Bar chart	Chart II Pie diagram
1	2	1	1 7/10	1	..
1 1/10	1	..	1 3/4	2	4
1 1/8	2	3	2	37	16
1 1/6	..	3	2 2/11	..	5
1 3/17	..	1	2 1/4	..	1
1 1/5	..	9	2 1/3	1	4
1 2/9	..	1	2 2/5	1	..
1 1/4	15	17	2 1/2	35	18
1 2/7	..	2	2 2/3	2	7
1 3/10	1	2	2 3/4	..	1
1 1/3	19	25	2 6/7	1	..
1 3/8	1	2	3	21	20
1 2/5	2	9	3 1/3	1	..
1 1/2	**132**	**95**	4	1	..
1 5/9	1	..	4 1/6	..	1
1 3/5	1	2			
1 2/3	7	38			
			Total.....	287	287

A much larger number judged the ratio correctly at 1:1½ in the case of the bar chart than in the case of the pie diagram. Of a total of 287 persons 132, or 46 per cent, made correct estimates for the bar figure

of Chart I and 95, or 33.1 per cent, correctly estimated the ratio as shown by the pie diagram of Chart II. Table II summarizes the figures of Table I.

TABLE II

SUMMARY OF ESTIMATES OF RATIOS SHOWN BY CHARTS I AND II

Estimate	Number		Per cent	
	Figure I Bar chart	Figure II Pie diagram	Figure I Bar chart	Figure II Pie diagram
From 1:1 to 1:1 2/5	43	75	15.0	26.1
1:1 1/2	132	95	46.0	33.1
From 1:1 5/9 to 1:4 1/6	112	117	39.0	40.8
Total	287	287	100.0	100.0

As a further test we may calculate the average deviation of the various estimates from the correct ratio. Based upon the data of Table I we obtain a value of .371 for the bar chart (Chart I) and .347 for the pie diagram (Chart II). While the advantage here seems to lie with the pie diagram, the difference is not great enough to be significant.

Results of set showing ratio 1:4

The frequency distribution of estimates presented in Table III shows even more clearly than that of Table I the greater accuracy of estimates based on bar charts than on pie diagrams. Of the 287 observers 119, or 41.5 per cent, made correct estimates for the bar chart of Chart III, while only 74, or 25.8 per cent, judged the ratio correctly for the pie diagram of Chart IV.

TABLE III

ESTIMATES OF RATIOS SHOWN BY CHARTS III AND IV

A is to B as 1 is to	Chart III Bar chart	Chart IV Pie diagram	A is to B as 1 is to	Chart III Bar chart	Chart IV Pie diagram
1 1/5	..	1	4 7/10	1	..
1 1/2	..	1	4 4/5	..	1
1 2/3	..	1	5	102	127
1 3/4	..	1	5 1/4	..	1
2 1/2	2	1	6	24	44
3	21	19	7	2	1
3 1/4	..	2	7 1/2	1	..
3 1/2	6	2	8	1	2
4	119	74	10 2/3	..	1
4 1/4	..	1	20		1
4 1/3	..	2			
4 1/2	8	4			
			Total	287	287

A summary of the frequency distribution is shown in Table IV.

TABLE IV

SUMMARY OF ESTIMATES OF RATIOS SHOWN BY CHARTS III AND IV

Estimate	Number		Per cent	
	Figure III Bar Chart	Figure IV Pie diagram	Figure III Bar chart	Figure IV Pie diagram
From 1:1 1/5 to 1:3 1/2	29	28	10.1	9.8
1:4	119	74	41.5	25.8
From 1:4 1/4 to 1:20	139	185	48.4	64.5
Total	287	287	100.0	100.0

The average deviations of the estimates from 1:4, based on the data of Table III, are .680 for the bar chart of Chart III and .990 for the pie diagram of Chart IV. In this instance the bar chart appears to be much superior to the pie diagram.

With such contradictory results as are shown in the study by Professor Eells, and in this one, we are perhaps no better off than we were before. While this study presents estimates from a greater number of observers than does that of Professor Eells, his study considers a greater number of diagrams than does this one. It is to be regretted that the number of persons observing Professor Eells' diagrams was so small that in several instances (Tables I and VI of his article) the difference in speed and accuracy of judgment of the bars and circles was too small to be significant as tested by their probable errors. Any attempt to settle definitely the controversy of the bar chart versus the pie diagram should be based on a number of charts and upon estimates by a large number of observers. Certainly the method of estimating in terms of percentages, as was used by Professor Eells, rather than in terms of ratios, as was done in this study, is more flexible and therefore preferable.

MEASURING THE FLUCTUATIONS OF EMPLOYMENT IN THE OHIO CONSTRUCTION INDUSTRY

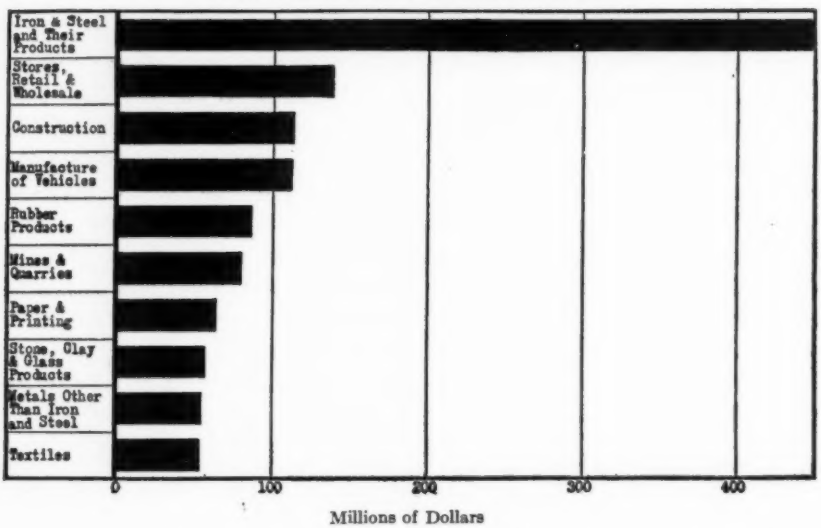
By Ralph J. Watkins, *Ohio State University*

The significant position which the construction industry occupies in the economic life of the nation has been pointed out on numerous occasions within the last few years. This position is due both to its absolute importance in its own right and to its position as the demand-industry for a host of other industries. The relative standing of the construction industry in Ohio is shown in Chart I.

CHART I

TEN LEADING GROUPS OF INDUSTRIES IN OHIO MEASURED BY TOTAL WAGE AND SALARY PAYMENTS, 1923

Source: Division of Labor Statistics, State of Ohio



The measuring stick is the total wage and salary payments of the several industries, as shown by the obligatory reports submitted to the Ohio Industrial Commission by all employers normally employing five or more persons. All industries are covered except interstate railroads. Agriculture is, of course, not properly represented, since few farmers employ normally five or more persons. The high rank of the construction industry is significant. In view of the unique importance of the

industry, the absence of national series reflecting the fluctuations of construction employment has been generally regretted.

The reason usually advanced for the absence of such employment series is the chaotic condition of the construction industry. It is pointed out that there are thousands of small-scale operators and, further, that their operations are scattered and not confined to a given plant. To secure an adequate sample which would reflect faithfully the fluctuations of the entire industry has been regarded as impracticable. However, it has been found upon investigation, as in so many other cases, that the facts of the industry when properly sifted do yield some order.

The number of construction firms reporting to the Ohio Industrial Commission in 1923 was 5,883, and of this number 2,185 were classified as general contracting firms. It has been found that the indices of seasonal variation of "All Construction" employment and "General Contracting" employment are almost identical. These indices, computed by identical methods, are shown in Chart II and Table I.

CHART II

SEASONAL FLUCTUATION IN EMPLOYMENT OF WAGE EARNERS, GENERAL CONTRACTING AND ALL CONSTRUCTION, STATE OF OHIO, 1914–1924

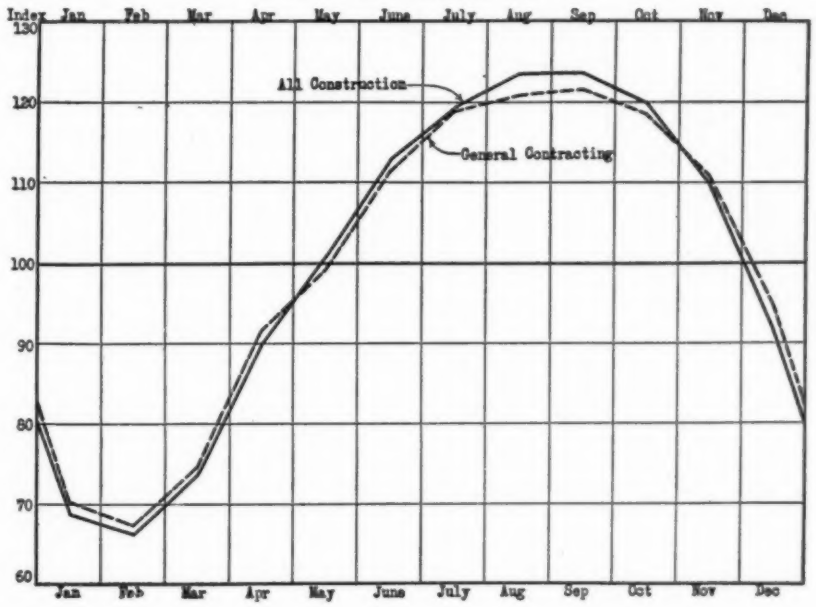


TABLE I

INDICES OF SEASONAL VARIATION IN EMPLOYMENT OF WAGE-EARNERS
General Contracting and All Construction, State of Ohio
Period Covered 1914–1924

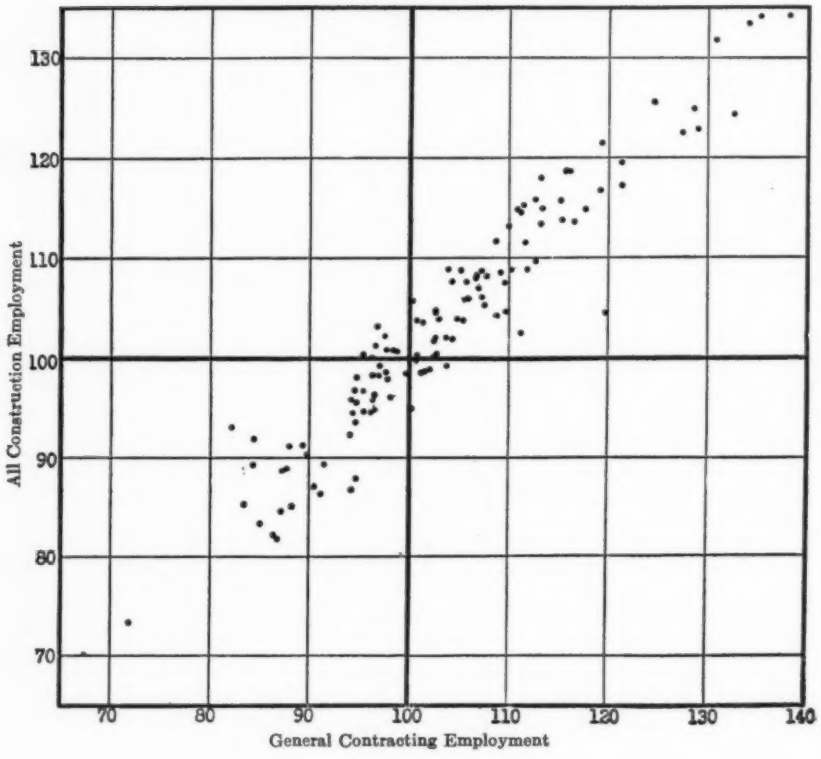
Month	All construction	General contracting
January	68.8	70.3
February	66.2	67.3
March	73.5	74.9
April	90.2	91.6
May	100.8	99.2
June	112.8	111.2
July	119.2	118.9
August	123.3	120.8
September	123.4	121.5
October	119.9	118.7
November	110.1	110.9
December	91.6	94.7

The correspondence between the fluctuations of the two series is even better shown in Chart III.

CHART III

SCATTER DIAGRAM OF LINK-RELATIVES, GENERAL CONTRACTING AND ALL CONSTRUCTION EMPLOYMENT, STATE OF OHIO, JANUARY, 1914–DECEMBER, 1924

January—December Relatives are Not Plotted



In this scatter diagram the concurrent link-relatives of the two series are plotted against each other. It is readily seen that the fluctuations are practically synchronous and uniform. These facts suggest that a group of general contracting firms should afford a representative sample. This greatly simplifies the problem since general contracting is carried on much more extensively by the larger organizations.

The records of the Ohio Industrial Commission are complete for the period 1914–1924, inclusive. These records, among other things, show the number of wage-earners employed on the 15th of each month by all employers normally employing five or more persons. It will be recognized at once that these records in the case of the construction industry supply highly important information in regard to seasonal fluctuations of employment in the industry. Unfortunately, the data are not comparable from year to year. The reports for the entire year are collected at the close of each year and the compliance apparently varies considerably from year to year, since the number of reporting firms varies widely. Not all of this variation can be charged to changes in business conditions. The series then are not comparable from year to year but are strictly comparable within a given year, since the report for that year is based on the records of identical firms. Because of this situation, the data are not subject to the usual methods of analysis for determination of indices of seasonal variation.

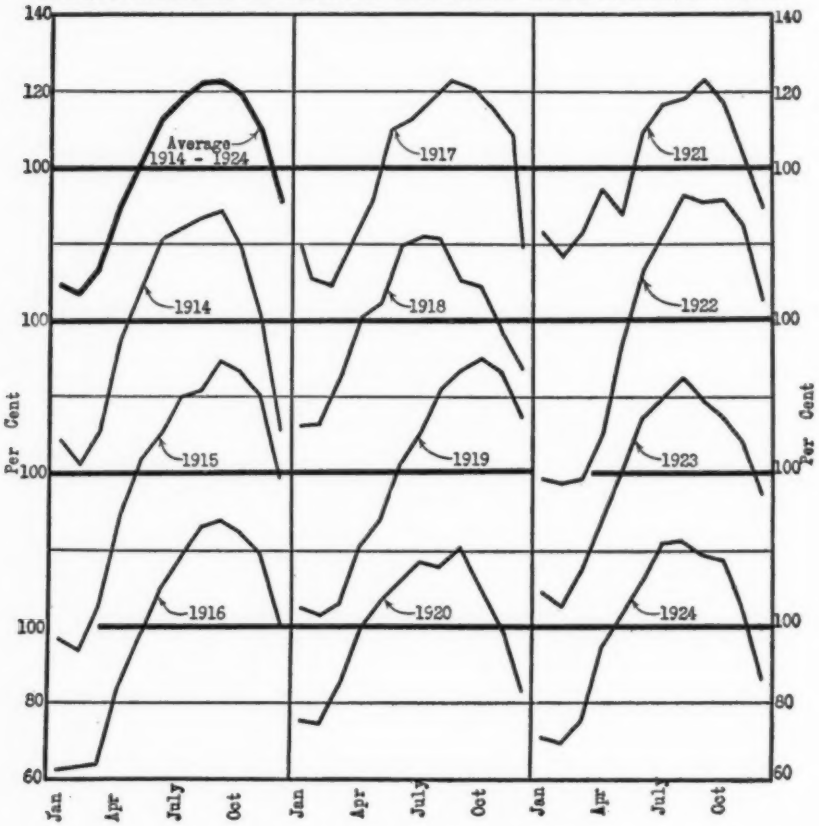
There is a method, however, which can be relied on to yield fairly satisfactory results. Each year can be put on its own base and monthly indices for that year computed on the basis of the average month for that year as 100. This can be done for the eleven years and an average index for each calendar month can be computed from the eleven indices. This is the method which was followed in computing the indices shown in Chart II and Table I. This is, of course, not the best method of arriving at a seasonal index, for the reason that the method makes no provision for adjusting the indices for the secular trend influence. However, the averaging of the eleven indices for each calendar month fairly effectively eliminates the trend factor in view of the fact that the period 1914–1924 was one of pronounced ups and downs. The consistent character of the seasonal movement in construction employment is graphically shown in Chart IV. It will be noted that the general direction of the seasonal curve is apparent in all years, whether they be years of depression or years of prosperity.

The industry is so consistent in its seasonal movement that the choice of an average to represent the seasonal movement, on the basis of the method described, raised no difficult problem. The arithmetic

CHART IV

SEASONAL INDICES OF EMPLOYMENT IN THE OHIO CONSTRUCTION INDUSTRY, FOR INDIVIDUAL YEARS 1914-1924

Average Month in Each Year Equals 100. Source: Bureau of Labor Statistics, State of Ohio



mean was used, but, as will be seen from Table II, the geometric mean or the median would have given practically the same results.

The records of the Ohio Industrial Commission on which the seasonal index is based do not reflect accurately the year to year fluctuations in construction employment in Ohio because they are not entirely comparable from year to year. The series described below was made possible by the coöperation of a group of general contractors. The general contractor membership lists of the Builders' Exchanges of Ohio were secured, and about 120 of these firms constitute the coöperating group. These firms have supplied their figures for the current year, and the employment records of most of these firms were secured through a coding arrangement from the individual files of the Ohio Division of Labor

TABLE II

INDICES OF SEASONAL VARIATION IN EMPLOYMENT OF WAGE-EARNERS

All Construction and General Contracting, State of Ohio
Period Covered 1914–1924

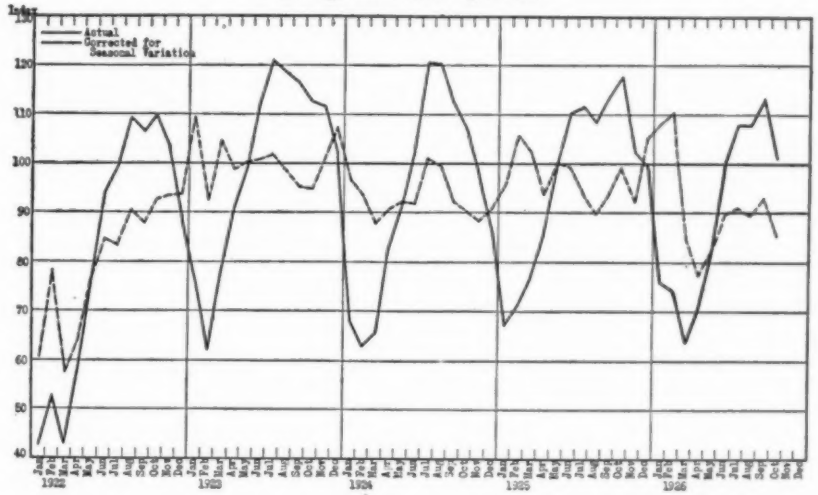
Month	All construction			General contracting		
	Arithmetic mean	Geometric mean	Median	Arithmetic mean	Geometric mean	Median
January	68.8	68.3	69.9	70.2	69.7	72.4
February	66.2	65.8	66.0	67.3	66.9	69.3
March	73.5	73.0	74.9	74.9	74.4	79.6
April	90.2	89.8	90.9	91.5	91.6	93.6
May	100.8	100.6	103.9	99.2	99.3	103.1
June	112.8	112.6	112.9	111.2	111.7	111.4
July	119.2	119.2	120.2	118.9	119.5	117.3
August	123.3	123.2	122.7	120.8	121.4	119.4
September	123.4	123.3	122.7	119.7	122.0	122.2
October	119.9	119.7	118.3	118.8	119.1	113.9
November	110.1	109.6	108.7	110.9	110.7	103.4
December	91.6	90.7	89.0	94.7	93.9	94.3

Statistics covering the period January, 1922, to December, 1925, inclusive. The actual and the seasonally corrected series are shown in Chart V and Table III. In order to correspond with the national em-

CHART V

EMPLOYMENT IN THE OHIO CONSTRUCTION INDUSTRY SINCE JANUARY, 1922

Average Month 1923 Equals 100



ployment series the average month of 1923 has been selected as the base period. The seasonal index used in correcting the actual series is the general contracting index shown in Chart II and Table I.

The series from January, 1923, to December, 1925, inclusive, is based on the employment record of 81 identical firms. The 1922 in-

TABLE III

INDICES OF EMPLOYMENT IN THE OHIO CONSTRUCTION INDUSTRY

January, 1922–October, 1926
Average Month 1923=100

Month	1922		1923		1924		1925		1926	
	Actual	Corrected for seasonal variation	Actual	Corrected for seasonal Variation	Actual	Corrected for seasonal variation	Actual	Corrected for seasonal variation	Actual	Corrected for seasonal variation
January	42.6	60.6	77.0	109.5	67.8	96.5	67.1	95.5	76.0	108.1
February	52.6	78.2	62.1	92.3	62.8	93.3	71.2	105.8	74.3	110.5
March	43.0	57.4	78.2	104.4	65.6	87.6	76.9	102.6	63.8	85.2
April	58.7	64.1	90.4	98.7	82.8	90.4	85.7	93.6	70.9	77.5
May	75.8	76.4	99.4	100.2	91.4	92.1	99.4	100.2	82.0	82.7
June	94.2	84.8	111.9	100.7	102.0	91.8	110.3	99.3	99.9	89.8
July	99.3	83.5	120.9	101.7	120.4	101.2	111.5	93.8	108.1	90.9
August	109.4	90.6	118.7	98.3	120.1	99.4	108.4	89.8	108.1	89.5
September	106.4	87.6	115.6	95.1	112.2	92.3	113.7	93.6	113.3	93.1
October	110.0	92.6	112.8	94.9	107.1	90.2	117.9	99.3	101.3	85.3
November	103.5	93.3	111.5	100.6	97.6	88.1	102.2	92.2	91.4	82.4
December	88.6	93.5	101.6	107.3	86.0	90.8	99.5	105.1	83.3	88.0

dices are based on the record of 73 of these 81 firms. The December, 1922 index was spliced onto the January, 1923 index on the basis of the ratio of change shown by the employment aggregates of the same 73 firms in both months. The index numbers for the other months of 1922 were chained to December, 1922.

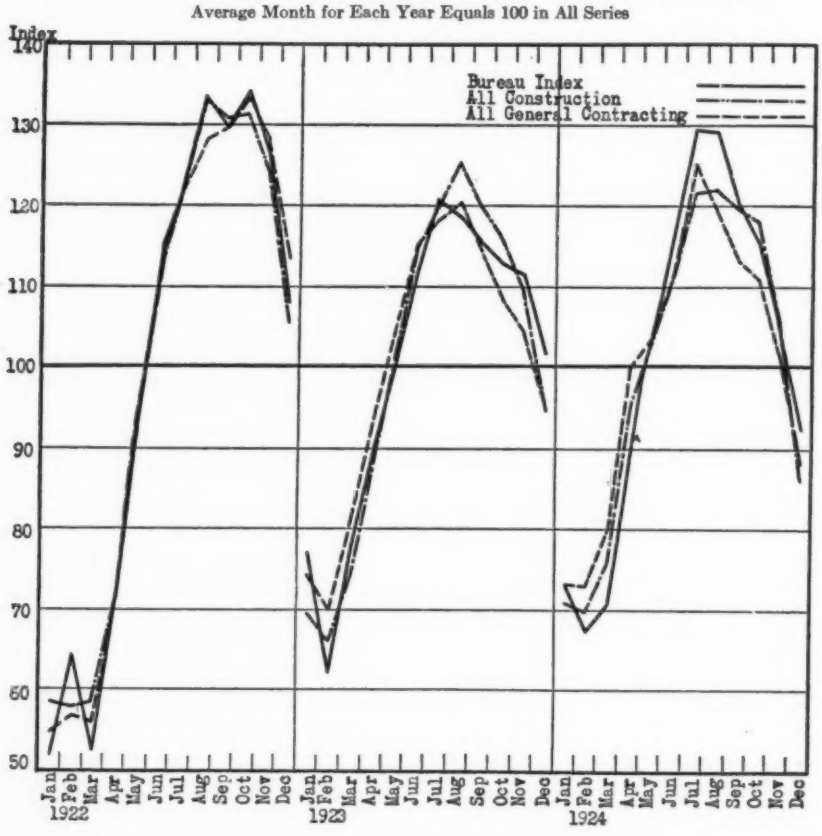
The 1926 indices present some difficulties. About 120 firms are coöperating during the current months and only 81 of these are represented in the 1923 base. Further, there are slight fluctuations in the number of reports received in time for monthly publication. The problem has been solved by the usual splicing method. The index for the current month is computed by determining the ratio of increase or decrease shown by the aggregates of the reports from identical firms and applying this ratio to the index for the preceding month. The numbers of firms represented in the indices for the months of 1926 are as follows: January, 86; February, 122; March, 122; April, 119; May, 124; June, 117; July, 112; August, 113; September, 111; October, 103. These figures also mean, of course, that the indicated numbers of reports were available for the given month and the preceding month. The index for the last month is preliminary and is sometimes changed slightly by the inclusion of the late reports. These series are published about the middle of each month in the Bulletin of Business Research, the monthly publication of the Bureau of Business Research of the Ohio State University.

The representative character of this employment index is shown graphically in Chart VI. The test covers the years 1922, 1923, and 1924 only because later complete records are not yet available. It will be noted that the Bureau's index is compared with the indices representing all construction employment and all general contracting employment in Ohio in the designated years. Each series in each year is placed on its own base—the average month of the given year. It was necessary to do this because, as pointed out above, the complete records are not entirely comparable from year to year. The close relationship between the fluctuations of the three curves is apparent. This raises the question as to the relative size of the sample. The Ohio Industrial Commission for 1924 received reports from 7,364 construction firms, and 2,771 of these were general contracting firms. The sample for 1924 is based on reports from 81 firms. A more significant comparison can be made by comparing the numbers of wage-earners represented by these firms. The average monthly number of wage-earners employed in 1924 by all construction firms reporting to the Ohio Industrial Commission was 69,839, by all general contracting firms was 29,921, and by the list of 81 firms was 3,779. The sample

CHART VI

COMPARISON OF EMPLOYMENT INDICES, OHIO CONSTRUCTION INDUSTRY

Average Month for Each Year Equals 100 in All Series



then represented 5.4 per cent of all construction employment and 12.6 per cent of all general contracting employment. For June, 1926, the number of wage-earners reported by the list of 117 firms was 7,478. This figure represents 10.0 per cent of the number reported by all construction firms and 22.9 per cent of the number reported by all general contracting firms in June, 1924. The 1925 records for comparison are not yet available.

THE LAWS OF GROWTH OF A POPULATION

By Sir George H. Knibbs, C.M.G.

PART II

16. Causes of automatic variations of rate of increase. The fundamental factors governing the rate of increase have been referred to in Section *3*. Some measure of variation is caused by the actual increases themselves, so also by migrations and deaths: to these reference will now be made.

When the reproductivity of a population according to age, and also the constitution according to sex and age, both remain constant, the rate of increase by births will obviously tend to be constant also. But with a population increasing by birth or by immigration, the constitution according to sex and age, is, of course, almost invariably changed, thus altering the reproductivity. Let y_x denote the proportion of a population between age x and $x+1$, and 1_x be the proportion of any number born surviving to between the same age limits. These remnants or survivors from births x years earlier are added in the course of a year to the number between age x and $x+1$, y_x say. Then for the population constitution to remain unchanged the ratio $(y_x+1_x)/y_x$ must remain unchanged for every age, *i. e.*, for each value of x. Thus the incidence of mortality according to age must remain constant in order to give this, that is to say the values of (say) m_x, or the proportion of those dying, between age x and $x+1$, of the group, alive between these age limits, must also continue unchanged. It is also to be noted that the sums of the survivors of age x to $x+1$, diminished by those removed by death between the same ages, must always bear the same proportion to the relative number, y_x, of those living at that age, in order to ensure constancy of constitution according to age. Similar propositions apply to migrants into or out of the population. These conditions, of course, are never exactly fulfilled, and sometimes the differences from them are such that the form of the curve of the values of y_x changes *quite appreciably* with the lapse of time, causing, therefore, the reproductivity of the population to change, even though in the individual it had not varied. Variations of increase arising in this way may be called *automatic*. In the main, and excepting in some measure migration, they are not subject to control. It is possible that the constitution of a population, according to sex and age, and to the incidence of mortality, may remain substantially constant, and yet the repro-

ductivity alter through change of mental attitude to birth control. Thus any change in point of view as to the proper limitations of natality, which results in restrictions of the measure of fecundity, will diminish the rate of increase.

Among minor automatic variations of the rate of increase itself may be mentioned also (a) the immediate influence of a large increase of births upon the rate itself, by relatively increasing the non-reproductive portion of the population; and (b) the effect of large infantile mortality itself on the birth-rate, by increasing the effective number exposed to the risk of maternity. The effect varies for different countries,[1] and in general is negligible as compared with the social and economic factors affecting increase.

17. Effect of the productivity of a territory. The productivity of any territory depends upon (i) a recognition of its natural resources, (ii) the skill and assiduity of its population in exploiting them, and (iii) the measure of the favorable operation of natural phenomena in regard to such productivity. Thus it depends upon the character of man's physical environment, and also upon man himself. Assuming the human element to remain constant, increases in the production of a territory may be expected (a) to increase the marriage-rate, (b) somewhat later to increase the birth-rate as a consequence, and (c) by reducing contraceptive influences also to increase the birth-rate directly. Thus a marked measure of correlation might be anticipated between the following curves for any particular country: (a) total production per inhabitant; (b) marriage-rates; (c) birth-rates. Moreover this, it might be thought, ought to appear very distinctly in a new country like Australia. As time goes on the increasing complexity in any community of the whole system of social-economic relations will probably make the measure of reaction less marked and relatively later. Unfortunately the yearly total production for Australia was not available earlier than 1908, when the table was compiled, but has been estimated for the particular years shown in Table XI.

In this table the ratios of the totals of the birth-rates to the totals of the marriage-rates show a steady fall with the lapse of time. The general trend of the ratio, totals of the birth-rates to the totals of the marriage-rates, may be roughly represented by the straight line, $5.47-0.21T$, in which T denotes the number of quinquennia after 1860–1864 (say the number of years after June, 1862, divided by 5). The results are set forth in Table XII.

The trend of the birth-rate itself also shows a marked diminution, but is not so well represented by a straight line. It falls for three 5-year

[1] See G. H. Knibbs, "The Mathematical Theory of Population," Appendix A, Vol. I, *1911 Census of Australia*, pp. 144–146.

TABLE XI

QUINQUENNIAL AVERAGES FOR AUSTRALIA OF MARRIAGE-RATES, OF BIRTH-RATES, OF INCREASE OF POPULATION PER 1,000 OF MEAN POPULATION, AND OF PRODUCTION PER HEAD

5-year	Population (million) (c)	Marriages	Birth	Births divided by marriages	Increase per 1,000 population	Total production (million £)	Per capita production
1860–4.....	1.233	8.56	42.54	4.97	38.52		
1865–9.....	1.474	7.67	40.28	5.25	37.42	(e) 34.5	£23.4
1870–4.....	1.722	7.12	37.59	5.28	30.40	(e) 49.1	28.5
1875–9.....	1.995	7.25	35.59	4.91	31.74	(e) 61.3	30.7
1880–4.....	2.347	7.90	35.08	4.44	38.04	(e) 73.6	31.4
1885–9.....	2.835	7.86	35.30	4.49	32.84	(e) 86.1	30.4
1890–4.....	3.273	6.82	33.34	4.89	24.50	(e) 98.0	29.9
1895–9.....	3.585	6.64	28.29	4.26	16.84	(e)107.2	29.9
1900–4.....	3.855	7.10	26.58	3.74	13.54	(e)121.8	31.6
1905–9.....	4.158	7.65	26.57	3.47	17.04	(e)157.8	37.9
1910–4.....	4.651	8.72	27.72	3.18	28.34	202.18	43.5
(a)1915–9	4.905	7.68	25.69	3.35	13.14	282.22	57.5
(b)1920–3	5.575	8.52	24.71	2.90	20.4	(d)365.50	(f)65.6

(a) War period. (b) 4-year average. (c) For middle year of 5-year period taken as mean of population December 31, 1861 and 1862, and each 5 years afterwards. (d) Mean of 4 years only, may be regarded as at end of 1920. (e) Interpolations based on estimates for 1871, 1881, 1891, 1901, and 1908. (f) May be taken to refer to end of 1920.

periods at about 2.45 per period, then continues for two periods without falling: it then falls again, still more rapidly, for about three periods, when it continues for two periods (with even a slight rise), after which it falls again. From these facts it is evident that the marriage and re-

TABLE XII

FALL IN THE RATIO OF 5-YEAR TOTALS OF BIRTH-RATES TO 5-YEAR TOTALS OF MARRIAGE-RATES: AUSTRALIA, 1860 TO 1923

Actual.....	4.97	5.25	5.28	4.91	4.44	4.49	4.89	4.26	3.74	3.47	3.18	3.35	2.90
Calculated.....	5.47	5.26	5.05	4.84	4.63	4.42	4.21	4.00	3.79	3.58	3.37	3.16	2.95
Differences.....	+.50	+.01	−.23	−.07	+.19	−.07	−.68	−.26	+.05	+.11	+.19	−.19	+.05

productive impulses of the Australian people have diminished during the period covered by the table, despite the fact that the production per head of population has shown a marked advance recently. For 30 years from 1870 it appears to have been sensibly linear, averaging about £30.1 per head, viz., till 1900. It then progressed at about $£1.6T^2$, where T denotes a 5-year period; that is after the quinquennium 1895–9, the increase was approximately (in pounds sterling) $30.1+1.6T^2$. These values give, from the 5-year period 1870–4 onwards, the results presented in Table XIII.

TABLE XIII

INCREASES BY 5-YEAR PERIODS IN THE TOTAL VALUE OF PRODUCTION IN AUSTRALIA, 1870 TO 1924

Actual.....	28.5	30.7	31.4	30.4	29.9	29.9	31.6	37.9	43.5	57.5	65.6
Calculated.....	30.1	30.1	30.1	30.1	30.1	30.1	31.7	36.5	44.5	55.7	65.4
Differences.....	+1.6	−0.6	−1.3	−0.3	+0.2	+0.2	+0.1	−1.4	+1.0	−1.8	−1.2

NOTE.—The last period is only 0.7 of 5 years.

These results are important, for they reveal the fact that the economic production of a population can be accompanied by influences which rob it of the appropriate effect on its reproductivity, although if the reproductive influences had been constant the effect would have followed. This is so since, other things being equal, the economic possibility of population increase is enhanced by increased productivity. By raising the standard of living, however, increase of economic productive activity can, of course, be made of no effect. It may be noted also that the development of secondary industries reinforces the urban populations, and results in effects identical with those which appeared in the United States in 1850–60. By the Census of April 4, 1921, the division of population in Australia was

Metropolitan	Provincial	Rural	Migratory	Total
43.01%	19.09%	37.35%	0.55%	100.00%

The metropolitan population increased between 1911 and 1921 from 38.03 to 43.01 per cent, say at the rate of one-half of one per cent per annum of the whole population. In the States of Victoria and South Australia, 50.05 per cent and 51.57 per cent resided in the respective capitals, and on December 31, 1923, 44.85 per cent of the whole Australian population resided in the capitals. This is much larger than in any other country, and is correlated with the economic factors and standards of living affecting the possibilities of rapid increase.

Whether Australian detailed results from year to year from 1901 onwards show any definite connection between productivity and population increase will now be considered.

18. Correlation of productivity, marriage- and birth-rates and rate of increase. The 17th Year Book of Australia (C. H. Wickens, Commonwealth Statistician) gives from 1871 to 1922–3, the production per head of population and also the "*relative productive activity*," corrected by the wholesale price-indexes up to 1907 and by production price-indexes from 1908 on. They are as shown in Table XIV.

The use of the values of the "relative productive activity" is perhaps not *wholly* satisfactory, because these doubtless reflect the effect of "wage-claims" and "standards of living" upon prices. But for examinations of questions of rates of increase, they are at any rate probably very much more free from objection than the actual value of the production per head. It is easy to recognize that very often, as the relative productivity becomes greater, this is shown later in the rates of increase. A graph will demonstrate that the increase is not *solely* related to relative productivity.

Apparently, on the whole, the main effect on the increase may be

TABLE XIV

PRODUCTION, ACTUAL AND RELATIVE, AND INCREASE-, MARRIAGE- AND BIRTH-RATES PER 1,000, AUSTRALIA, 1871 TO 1923

Year	Actual production per head	Relative productive activity	Actual per 1,000	Increase factor	Calculated	Marriage per 1,000	Births divided by marriages	Births per 1,000
1871.....	£27.46	543	32.2			6.94	5.57	38.66
81.....	30.83	667	33.7			7.60	4.64	35.26
91.....	29.65	762	28.4			7.47	4.60	34.47
2.....	28.81	761	20.0			6.74	5.00	33.65
4.....	24.45	793	19.3			6.08	5.07	30.83
6.....	26.06	686	17.6			6.55	4.34	28.43
9.....	30.21	906	14.0	.0168		7.03	3.88	27.27
1901.....	29.96	746	15.8	.0176	15.5	7.32	3.71	27.16
2.....	28.29	654	13.2	.0180	13.1	7.26	3.68	26.71
3.....	30.04	695	10.7	.0184	11.8	6.67	3.80	25.29
4.....	30.78	839	14.7	.0188	12.8	7.02	3.76	26.41
5.....	33.68	899	14.8	.0192	15.8	7.25	3.62	26.23
6.....	35.94	921	14.5	.0196	17.3	7.49	3.55	26.57
7.....	39.90	949	17.2	.0200	18.1	7.87	3.40	26.76
8.....	38.97	942	17.0	.0204	19.0	7.76	3.43	26.59
9.....	40.29	1,062	21.7	.0208	19.2	7.90	3.38	26.69
1910.....	42.43	1,070	23.4	.0340	22.1	8.37	3.19	26.73
1.....	41.19	1,000	33.6	.0340	36.4	8.79	3.09	27.20
2.....	43.52	984	37.8	.0340	34.0	9.06	3.16	28.60
3.....	44.52	1,026	31.0	.0340	33.5	8.63	3.26	28.15
4.....	42.25	817	15.9			8.76	3.19	27.90
5.....	51.01	958	−0.5			9.07	2.99	27.06
6.....	52.30	908	−10.4			8.14	3.26	26.57
7.....	54.91	897	13.0			6.81	3.86	26.27
8.....	56.58	868	19.8			6.59	3.79	25.00
1919-20.....	63.96	828	43.8			7.80	3.02	23.53
20-21.....	72.77	925	20.3			9.62	2.65	25.45
21-22.....	62.91	967	18.1			8.59	2.90	24.95
.....			22.5			8.03	3.07	24.69
22-23.....	67.85	940	20.7			7.83	3.04	23.77

expected to occur in the year following the change in the relative productivity, obviously a very probable consequence. Or it may, for example, be supposed that some effect tends to express itself even during the initial year of the change; that the maximum effect is in the following year, and that each year afterward the effect in question tends to diminish. Thus, for example, it may well be expected that the effect will be as the reciprocal of the square of the time, as if for the years 0, 1, 2, 3, 4, the relative effect may be supposed to be of the order $1/4$, 1, $1/4$, $1/9$, $1/16$, etc.

The data in the preceding table, however, lend very little support to the envisaging of the matter in this way. On the other hand, from 1899 to 1909 the increase seems to be roughly given, merely by multiplying by a factor increasing linearly with the lapse of time. These factors are shown in the column, "Factor," and the products are inserted on the next lower line. At 1910 this progression fails altogether and the constant factor .034 roughly applies till 1914, the year of the outbreak of the war.

The population and economic disturbances are so great during the period from 1914 onward, that any analysis is impracticable. The

whole result is, that while there is some relation between the relative productive index and the rate of increase, it is not a simple one.

We now consider the yearly details. For the period 1901 to 1915, the ratio of the birth-rates to the marriage-rates generally decreased, as has been shown earlier, viz., by the 5-year averages given in Table X. A straight line drawn from the value (5.57) for 1871 to the mean of the results (3.14) for 1911 to 1915 gives the general trend of the ratios for individual years very well. It indicates that the ratio diminished about 0.058 annually, as shown in Table XV.

TABLE XV

PROGRESSIVE DIMINUTION OF RATIO OF BIRTH-RATE TO MARRIAGE-RATE

Year	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915
Births divided by marriages	3.71	3.68	3.80	3.76	3.62	3.55	3.40	3.43	3.38	3.19	3.09	3.16	3.26	3.19	2.99
Calculated	3.84	3.78	3.72	3.66	3.60	3.55	3.49	3.43	3.37	3.31	3.26	3.20	3.14	3.08	3.02

This, of course, is very similar to the result indicated in Section *17* and, since the marriage-rates are sensibly constant, shows clearly that the reproductivity of the population is diminishing, despite the increasing absolute production per head, and despite the high relative productivity as compared with that of the years 1871–1881 and 1891. The whole of the facts show that although the conditions would admit of more rapid increases in population, the social-economic developments are such as to prevent it.

19. Population density and its effect on increase. A comparison of the different physical and climatological characteristics of various countries, shows at once that their population carrying power per unit of area is very diverse. For this reason the crude densities, D, the number of persons, say, per square mile, do not at all reveal the possibilities of countries for population increase. Were it possible, however, to ascertain their *relative* densities, k say, the ratio of an actual population P to the possible population L, that is P/L, a better measure of the ultimate opportunity for increase would then exist. This measure is $1-k=(L-P)/L$, (see formula (7)), and is zero for a population-saturated territory. If A be the area of a country, its greatest possible crude density is L/A, while its actual density is:

$$D=P/A=kL/A$$

However, L is an undetermined quantity. For a given region, and for any given moment, it depends upon physical and climatological char-

acteristics and upon the knowledge and skill of its population in using it to the best advantage. Thus at present k is practically not a measurable quantity for any country. At best it can be only very roughly estimated. If the areas of a number of countries are arranged in order of magnitude the densities on the whole are found to decrease, as Table XVI demonstrates.

TABLE XVI

POPULATION DENSITIES AND AREAS OF VARIOUS COUNTRIES

Region	Density	Area (square miles)	Region	Density	Area (square miles)
Macao	18,716	4	Belgium	641	11,752
Monaco	2,870	8	Great Britain	482	89,047
Barbados	953	166	Prussia	323	113,685
Bermudas	1,074	193	Italy	329	117,982
French India	1,369	196	Spain	111	194,800
Hongkong	1,599	391	France	184	212,659
Kwantung	1,687	538	United States	37	2,973,774
Straits Settlements	567	1,600	Australia	1.8	2,974,581

The reciprocity of the relation is obviously not perfectly regular, but shows that, on the whole, very dense populations are restricted to relatively small areas.

It may be noted that Japan and China and her dependencies, with densities of 295 and 102 per square mile, respectively, have areas of 260,738 and 4,277,179 square miles, and thus do not at all fit into the scheme of relations suggested in the table. This scheme cannot, however, be represented by any simple formula of hyperbolic type. Nor can it be taken as showing anything more than that dense populations are possible only under circumstances which cannot apply to extended regions. In the nature of the case these cannot be general for large areas and thus the density of the populations of cities cannot, of course, become general. The characteristics of the preceding table also apply to cities. Thus we have for certain cities:

TABLE XVII

REGIONS OF GREAT DENSITY PER SQUARE MILE

City, etc.	Density	Area (square miles)	City, etc.	Density	Area (square miles)
Trieste*	6,450	37	Greater London	10,790	693
Département Seine	23,846	185	North Holland	1,254	1,066
New York	18,796	299	South Holland	1,534	1,131
Berlin	11,287	337	Milano	1,560	1,221

* An exception to general trend.

In regard to many lands, however, the fact is that they have not at all approached their population limits, even under the prevailing social-economic system.

It is important to notice that no dense populations are actually maintained by the areas they occupy. Thus, to take an extreme case, the average area per inhabitant at Macao is 1,490 square feet, say a square of less than 39 feet side. For the cultivated part of Japan there are about 4 persons per acre, say each averaging a square of 105 feet side. In Shantung a family of 12 people, 1 milch cow, 1 donkey, and 2 pigs lived on the produce of 2½ acres of farm land,[1] say a square of 95¼ feet per person. Belgium has about 1 per acre, say a square of about 209 feet side, but is maintaining its population not on this directly, but only through its secondary industries.

The populations of a considerable number of countries are maintained more or less by their *purchasing power of foodstuffs from elsewhere*, such purchasing power being attained by marketing their secondary productions. Thus dense populations are less self-dependent and the possibilities of increase become dependent upon their secondary activities and their relations to the rest of the world.

In Table XVIII are shown the densities, birth-rates, and rates of natural increase of a number of countries.

TABLE XVIII

POPULATION DENSITIES, BIRTH-RATES AND RATES OF NATURAL INCREASE

Country	Density per square mile	Birth-rate	Natural increase*	Country	Density per square mile	Birth-rate	Natural increase*
Sweden	35	18.8	7.8	Hungary	226	22.4	....
Spain	111	30.5	4.6	Switzerland	243	19.6	5.0
Bulgaria	125	34.2	....	Japan	295	34.2	9.7
Rumania	142	40.2	....	Italy	329	30.4	8.1
France	184	19.4	-3.4	United Kingdom**	392	19.9	11.0
Denmark	192	22.3	10.9	Netherlands	537	25.9	13.2
Austria	202	22.8	....	Belgium	642	18.8	0.6

* Per 1,000 of mean population. ** England and Wales.

The table shows that there is no general relation between population density and birth-rate or between it and rate of natural increase. Social-economic studies reveal that economic pressures, dependent upon standards of living and the economic productivities of countries, as well as upon their reproductive impulses and traditions and their hygienic conditions, profoundly influence the results. Compare, for example, the situation in respect to Japan, the United Kingdom, Den-

[1] According to F. H. King, *Farmers of Forty Centuries.* See Professor J. Russell Smith, *The World's Food Resources, 1919*, p. 520.

mark and the Netherlands, with the conditions for France, Belgium, Spain, and Switzerland.

Countries with very large birth-rates (*e. g.*, Russia) have very large rates of infantile mortality, so that the rate at which children are produced who will attain to 1, 2, ... or n years of age is usually nothing like the equal of the birth-rates. For this reason the net increase of the population is the only fairly satisfactory measure of growth. In a study made in 1908, the infantile mortality was found to range between 69 and 412 per 1,000 births, and the birth-rates to range between 26.2 and 50.0 per 1,000 mean population.[1]

20. Effect of war on birth-rate. It is obvious that war will operate powerfully to limit population by disturbing all normal economic relations and production, and by reducing birth-rates. The recent war has given a special opportunity for reviewing the latter effect. In Table XIX the rates per 1,000 mean population are given, (I) for 1915, (II) for 1916 to 1918 (in nearly all cases), and (III) generally from 1920 to 1921, but in Germany for 1920 and Bulgaria for 1919.

TABLE XIX

WAR AND POST-WAR BIRTH-RATES IN EUROPE

Country	(I)	(II)	(III)	Country	(I)	(II)	(III)
Germany	20.4	14.8	25.7	Belgium	16.5	12.1	21.3
Prussia	21.1	15.1	24.2	Bulgaria	39.2	18.9	32.6
Bavaria	21.3	15.8	26.5	France	11.6	10.7	20.5
Saxony	?	12.3	22.8	Great Britain	23.0	20.8	22.8
Wurtenberg	19.8	14.7	24.4	Hungary	23.7	16.1	29.5
Austria	18.5	14.3	23.0	Switzerland	19.5	18.8	20.9

These effects are, of course, insignificant as compared with those of the Thirty-Years War (1618–1648), which disintegrated Germany, reduced the population to much less than one-half, led to terrible ignorance, brutality and despotisms, and ended the material prosperity which had been developing during the previous century.

21. Effect of economic disaster on rate of increase. Australia affords an excellent example of the effect of a considerable economic disaster upon human increase. From 1891 to 1902 the number of sheep fell from over 106 millions to 53.7 millions, and from 1894 to 1902 the cattle from over 12 millions to 7.1 millions. Such relatively large losses might be expected to be followed by a decrease in the rate of population growth. From 1883 to 1891 the annual increase over all had been at the rate of 32.7 per 1,000 of the population. Subsequently it was as follows:

[1] See G. H. Knibbs, *Journal Royal Society*, New South Wales, 1909 (October 7, 1908), pp. 238–250, in particular pp. 245–249.

From December 31 of.....	1883–1891	1891–1898	1898–1903
Population increase per 1,000 per annum.....	32.7	17.7	13.9

Although this decrease is not *wholly* attributable to economic losses, in the main it was a direct consequence thereof and reveals the fact that the economic well-being of a territory is a fundamental factor in creating the possibility of increase. It is, however, by no means the sole factor, and may be counteracted by an appropriate reduction of the standard of living, by the maintenance of thrift, and—within limits—of the *effective* reproductive impulse, that is of the survival birth-rate, or the birth-rate less the infantile mortality.

22. Conclusions. It seems desirable to sum up the conclusion to which one is led by the considerations submitted hereinbefore.

Having regard to the fact that adaptations of the logistic curve to actual populations proceed upon an assumption, which from its intrinsic nature never strictly represents the actual facts, and that, therefore, it is merely an empirical fitting of a particular type of curve to given results, it appears to be desirable to re-state the laws of population-increase:

(I) In a new country, the resources of which are relatively very large, a population increases according to the measure of its reproductive-impulse, if all factors influencing it remain constant.

(II) When, in regard to the total resources of the territory, the developed population is so great that it reacts upon the population so as to limit the reproductive impulse, this limitation must ultimately become very great, and necessarily so; finally it could reach a point where further increase of numbers would cease to be possible.

(III) The rate of increase can be increased by several things, viz.: (a) by the discovery of hitherto unknown resources; (b) by a more skilful exploitation of known resources; (c) by reducing the standard of living so long as it does not interfere with the productive efficiency of the occupation; (d) by increase of the reproductive impulse so long as it is possible with the resources at command, or with the possibilities of more thrifty or more efficient living.

(IV) All advancement of the standard of living which does not result in increased productive efficiency tends to limit population.

(V) Any analysis leading (a) to a logistic law or (b) to an empirical law of development which actually represents the existing population, merely represents the past modifications with time: the legitimacy of any projection into the future depends upon correct estimations of relevant conditions.

(VI) With most populations of the Western World, the existing drift corresponds to the elaboration of a higher standard of living, not only unessential to the maximum productive efficiency, but actually short of it and tending to limit population.

(VII) In order to estimate the possible population of any territory considered in itself, it is necessary to estimate its possibilities of food and other production, aiding food acquirements, and also the limitation of all unnecessary developments in the standard of living.

(VIII) In view of possible overpopulation of the world according to its existing standards, the acute question of the future will be whether world policy is best directed to securing larger numbers, living with a moderate standard, or smaller numbers living according to an elaborated standard.

(IX) Since the issues of war between peoples involve population limitations, great economic losses, and great suffering, a consensus of opinion in regard to this is probably even now a world necessity.

NOTES

DIFFERENTIATION IN INDEX NUMBERS OF SECURITY PRICES

By Herbert Marshall, *Ottawa, Canada*

Very much light has been thrown upon the subject of index numbers in recent years both by theoretical discussions and by the ever increasing use of them for various purposes. Their sphere of usefulness seems certain to be extended in the future. Up to the present the development has been uneven. A considerable degree of unanimity of opinion has emerged with regard to certain phases in the construction of index numbers of wholesale prices. This is due to the excellent work of Fisher, W. C. Mitchell, Knibbs and many others. The subject has been very thoroughly discussed and an extensive literature dealing with it is extant. One branch of the general field of index numbers which has not yet met with such thorough study is that dealing with security prices. True, Fisher and Mitchell have made valuable contributions in that field also, but there still remains much to be done before this type of index number attains the same degree of development. The intention of this note is to describe and differentiate between two types of security price indexes which are computed by the writer as prices statistician in the Dominion Bureau of Statistics for Canada.

One fact which has emerged from the discussion of wholesale price index numbers is that the method of computation depends upon the purpose which the index is meant to serve. This principle applies with at least equal force to security price indexes, yet is one which does not seem to have received sufficient recognition by some who issue or publish them. The results which ensue from the computation of security price index numbers by different methods are so wide apart that the man on the street is sure to experience bewilderment when he sets them side by side. Something ought to be done to remove this difficulty.

In 1924 the Dominion Bureau of Statistics computed an index number of 31 industrial common stocks, base 1913, weighted by the quantity of stock outstanding. We shall call this index "A." It registered 212.6 in September, 1926. For various reasons, to be explained later, it could not react with sufficient sensitivity to the speculative aspect of

stock market activity. Consequently another index, which we shall call index "B," was constructed to supplement the former. The method adopted was similar to that used by Professor Fisher in computing his index numbers of prices, sales and values of best selling stocks on the New York Exchange. Weekly and monthly index numbers were then computed with base January, 1925, weighted with the number of shares sold, of the 25 best selling common stocks in each week on the Montreal and Toronto Exchanges. The index number for September, 1926, was 211.3 or almost the same as for index "A," which was on a 1913 base when prices were at a much lower level than in 1925. Converting index "A" to a January, 1925, base by taking the figure for that month and representing it by 100—a rough method but accurate enough in the present case—the index for September, 1926, would be 159.2. These two index numbers, "A" and "B," registering 159.2 and 211.3 respectively for the same month are sufficiently wide apart to arouse comment from the uninitiated, yet both are probably trustworthy measurements of movements in security prices but they measure movements of a different character. In using such indexes it is absolutely essential that the nature of the thing they are meant to measure should be clearly understood and this distinction should be emphasized in their presentation. The differences in the two may be expressed as follows:

The index numbers shown in Table I, Index "A," are those for a fixed list of 31 industrial stocks, and in Index "B" for a variable list of 25 best selling stocks. The list of stocks used in "A" remains the same during the whole period for which the index is constructed (except where adjustments have to be made for stock-splits, etc.). While it consists at the outset of stocks which are active, no allowance is made for changes in activity during the period. At the time the list was made up a stock may have had a record for activity but later may have become relatively quiescent. Again, in "A" the weights used are constant over the whole period. No account can therefore be taken of the great changes in activity which occur in the trading of individual stocks except in so far as these are reflected in price changes. The latter certainly give some indication of speculative movements but not a sufficiently accurate picture when weighted by stock outstanding. In order to obtain a true index of speculative activity the fluctuations in the number of shares sold must be taken into account. If this is not done then the influence of the price of any particular stock will not be sufficiently considered. For example, suppose we have a list of five stocks with prices and weights as follows:

	Weights, stock outstanding	Prices	
		One month	Second month
1st case: A	1,000,000	50	100
B	2,000,000	100	300
C	4,000,000	25	75
D	1,000,000	100	200
E	3,000,000	75	150
			Index 244
	Weights, number of shares sold		
2nd case: A	5,000	50	100
B	100,000	100	300
C	100,000	25	75
D	5,000	100	200
E	1,000	75	150
			Index 294

Here the difference in the weighting systems is responsible for wide differences in the indexes. For a prices index of speculative activity the use of stock outstanding for weights does not give the stocks which are the subject of speculative attention at the moment sufficient influence on the result, though their price may rise or fall more than others in the list. Their proper influence in the movement of speculative prices can only be secured by weighting them with the amount of stock sold. A system of weighting by amount of stock outstanding while good for other purposes is not adequate when it is desired to measure changes in speculative prices, because the influence of the price of stocks which are the principal subjects of speculation at the moment are underweighted relatively to other stocks. In order to make an index of this kind there are three variables instead of one as in the fixed list weighted by stock outstanding. Prices, of course, vary; weights vary, and the list of stocks varies. But these variables can all be handled by the use of the Fisher ideal formula, as used by Professor Fisher himself in computing index numbers of security prices, sales and values. The index for one week or month is calculated in association with the previous week or month by the ideal formula:

$$\sqrt{\frac{\Sigma P_1 Q_0}{\Sigma P_0 Q_0} \times \frac{\Sigma P_1 Q_1}{\Sigma P_0 Q_1}}$$

and this index is connected with all that have gone before by simple multiplication. The plan of selecting a specified number of best selling stocks, representative of the great bulk of trading on the exchanges, secures the automatic elimination of stocks which have come up into the main vortex of trading but which have passed into quietude again. Obsolescence in stocks is thus automatically controlled and the list is up

to the minute so far as speculative activity is concerned. There may be times when a few in the list of best sellers dominate the index. In fact, for some months two stocks in the Canadian list of 25 constituted the biggest part of the trading, but the trend of the speculative price index can only be accurately secured by allowing such stocks to exert the full influence of their activity on it. If the biggest part of trading is concentrated on two, three, four or half-a-dozen shares in any particular week or month, then it is the prices of those shares which largely determine the profits and losses of the body of speculators active on the exchange, and the true situation can only be adequately pictured by giving such shares their full trading weight in the index. The other system of weighting diminishes this influence.

At this point it may be well to call attention to the fact that the market indicators consisting of stock averages which are simple arithmetic averages of stock prices are only a rough approximation to actual conditions because of their lack of a system of weights. In computing such indexes each stock counts as one and only one in making the average. That is, though some stocks may be many times as important in the market as others they can exert an influence on the average commensurate only with the price of one share. The consequence is that averages so constructed give a feeble report of speculative market movements. Such activity is much more vigorous than simple average prices can possibly indicate. One is reminded of the difference between a black and white representation of a colored masterpiece and the original. The vehicle is quite inadequate to present the true facts. This is shown in Table I by the difference between Index "C" and Index "B." The former is an unweighted index of the average prices of stocks in the list of best sellers. Its construction is similar to that used for the various well-known market averages. This index was 143.2 in September as compared with the weighted index 211.3 (Index "B"). It is evidently but a faint indicator of what actually took place. Even Index "A," weighted by stock outstanding, gives a better account of speculative conditions than Index "C." The characteristics of the two index numbers "A" and "B" may now be summarized.

Index "A" consists of a fixed[1] list of industrial stocks weighted by constant weights of stock outstanding. This index has only one variable, viz., prices.

The purpose of Index "A" is to indicate changes in the value of a

[1] It is difficult to keep such a list intact for a long period. Something can be done by adjustments for stocks which are split, etc., but this does not obviate the difficulties which develop through amalgamations, etc. Such an index needs to be revised at frequent intervals.

general list of outstanding industrial stocks. It shows that the market value of the outstanding stock in the weighted list of 31 industrials included had risen more than twofold since 1913 and this may be taken as indicative of the whole field of common industrial stocks. For the investor this is a satisfactory index since he is interested in the movement of stock prices over a considerable period rather than from a merely speculative point of view. This index may also be used for such purposes as comparing the movement of the prices of shares in business enterprise with movements of commodity prices, with movements in

TABLE I

INDEX NUMBERS OF SECURITY PRICES

	Index "A" Fixed list of 31 industrial stocks weighted by stock outstanding		*Index "B"* Variable list of 25 best selling stocks on the Montreal and Toronto Exchanges weighted by stock sales	*Index "C"* Unweighted index of stock market average prices
Base	1913	January 1925 Converted	January 1925	January 1925
1925				
January	133.5	100	100	100
February	141.3	105.8	108.9	...
March	140.0	104.9	105.7	...
April	139.9	104.9	108.6	...
May	143.4	107.4	109.9	...
June	146.3	109.6	106.1	...
July	150.9	113.0	111.8	...
August	161.8	121.2	123.2	...
September	163.4	121.6	132.8	...
October	171.6	128.5	147.2	...
November	171.0	128.1	145.7	...
December	175.5	131.5	150.4	...
1926				
January	185.6	139.0	163.2	...
February	197.0	147.6	182.9	...
March	189.6	142.0	171.1	...
April	186.7	139.8	171.4	...
May	182.8	136.9	171.0	...
June	187.7	140.6	179.4	126.0
July	193.7	145.1	182.9	128.1
August	203.6	152.5	199.3	133.0
September	212.6	159.2	211.3	143.2

circulating media, and with many phenomena of the business cycle. It is the best suited for general purposes.

Index "B" consists of a variable list of the 25 best selling common stocks on the Montreal and Toronto exchanges. It is weighted by stock sales which change daily, computed weekly and monthly and then linked by multiplication to preceding index numbers. It has three variables. Its purpose is to obtain an index of security prices particularly sensitive to speculative activity. This is ensured by weighting current selling prices of stocks by current sales and by the elimina-

tion of all stocks from the list except best sellers. This index emphasizes prices of stocks being vigorously traded currently. Weighting by stock sales in effect produces an index of weighted average prices—though it is not the simple variety—of current stock transactions. Index "A" deals with aggregate rather than average prices. Its emphasis is upon the aggregate movement of the prices of a list of securities fixed as to identity and quantity. The oscillation of graphic lines representing indexes "A" and "B" will be more extreme in the latter but this more faithfully represents speculative price movements under actual conditions.

THE EFFECT OF VIOLENT PRICE-FLUCTUATIONS UPON THE SALARIES OF CLERGYMEN

By Edward L. Thorndike and Ella Woodyard, *Institute of Educational Research, Teachers College, Columbia University*

It is the purpose of this note to report the changes in the salaries of clergymen from 1860 to 1924, showing in particular the amount of discrepancy and length of lag between rises and falls in the cost of commodities and rises and falls in these salaries.

The original data are the official records of the New England and New York Conferences of the Methodist Episcopal Church from 1860 to 1924. The former practically covers Massachusetts; the latter roughly covers the eastern part of New York, exclusive of Long Island and part of New York City. In the Methodist Episcopal Church until 1900, no parish was permitted to retain any clergyman continuously for more than three years. Consequently there was keen competition among parishes to obtain the best clergyman (in their opinion) for the salary they could offer, and there was keen competition among the clergymen to obtain parishes which were desirable in respect to salary and other conditions. The appointments were made annually by a bishop in authority over the conference, with the advice of the district superintendents or "presiding elders," as they used to be called. After the three-year limit was removed, there was little change in the actual practice. Parishes and clergymen sought change much as before. Raising the salary in one parish has, other things being equal, a very great and immediate effect in attracting an abler man to that parish. It should be noted that a clergyman has a claim to be appointed to some parish, unless he voluntarily withdraws for a period or permanently. Raising salaries thus does not secure abler clergymen in general, save after a long interval by attracting an abler type of candidate in youth; and lowering salaries does not decrease the quality of the group in general, save in the very rare cases where such action would induce the abler men to seek employment outside the Christian ministry.

It is the custom to provide a furnished house in addition to the cash payment, and a statement of the alleged rental value of this is included in the official records.

The facts which we used are, however, the cash payments alone, since they are the more reliable and the more significant for our pur-

pose. There are occasional irregularities or ambiguities due to absence from work for part of the year, allowances for a pastor and an assistant with the nature of the division of salary unstated, and other complications which we have allowed for to the best of our ability. We used the years 1860, 1862, 1864, 1866, and so on, to 1924, in the case of the New England Conference; and the years 1862, 1864, 1866, and so on, to 1924, in the case of the New York Conference (the records for 1860 were not available).[1]

We have then for these years, in each of the two conferences, a frequency table of salaries, making a series of 33 and 32 such tables, ten of which appear as Table I. The averages are computed from these

TABLE I

DISTRIBUTIONS OF SALARIES IN THE NEW ENGLAND CONFERENCE, IN 1860, 1862, 1864, 1866, 1868, 1870, 1872, 1874, 1876, AND 1878

A parsonage is furnished in addition to the salary entered here

Salary in dollars	Frequency in									
	'60	'62	'64	'66	'68	'70	'72	'74	'76	'78
0 to 99	1	1	..	1	..	..	1	..	..	1
100 to 199	..	3	2	..	..	..	..	2	..	3
200 to 299	6	11	8	2	..	2	3	2	1	12
300 to 399	15	18	15	5	1	..	3	2	5	5
400 to 499	25	26	16	5	10	7	3	7	6	6
500 to 599	30	22	28	25	12	9	9	8	7	14
600 to 699	23	17	20	24	15	18	11	18	13	17
700 to 799	10	16	12	21	21	18	14	12	10	17
800 to 899	6	7	7	24	21	19	20	15	12	13
900 to 999	2	4	4	3	7	5	14	15	9	10
1,000 to 1,099	13	5	13	14	18	25	22	24	23	17
1,100 to 1,199	2	3	2	5	4	7	3	7	5	11
1,200 to 1,299	..	7	4	4	10	9	17	16	11	8
1,300 to 1,399	3	..	2	2	2	3	5	8	6	6
1,400 to 1,499	1	..	..	2	3	4	6	4	7	8
1,500 to 1,599	..	1	2	8	7	7	6	8	6	5
1,600 to 1,699	..	..	..	1	2	6	4	4	2	3
1,700 to 1,799	..	..	1	2	3	..	2	5	2	5
1,800 to 1,899	1	1	1	..	8	3	3	3	1	1
1,900 to 1,999	..	..	..	..	1	1	..	2	2	2
2,000 to 2,099	..	..	..	1	4	12	10	7	6	5
2,100 to 2,199	..	..	..	..	3	3	..	2	4	5
2,200 to 2,299	..	..	..	..	1	2	5	4	2	1
2,300 to 2,399	..	..	..	..	..	1	3	1	1	1
2,400 to 2,499	..	..	..	..	..	2	1	3	..	1
2,500 to 2,599	..	..	..	..	..	2	3	5	4	4
2,600 to 2,699	..	..	..	2	..	1	..	2	2	1
2,700 to 2,799	..	..	..	..	..	1	1	1	1	1
2,800 to 2,899	..	..	..	..	1	..	2	3	2	4
2,900 to 2,999	..	..	..	..	..	..	..	..	1	..
3,000 to 3,099	..	..	..	..	..	1	3	2	..	2
3,100 to 3,199	..	..	..	..	..	..	also	1 at	6 from	1 at
3,200 to 3,299	..	..	..	..	..	..	1 at	3,800	3,500	4,200
3,300 to 3,399	..	..	..	..	..	..	4,500	2 at	to	1 at
3,400 to 3,499	..	..	..	..	..	..	1 at	4,000	4,500	4,500
3,500 to 3,599	..	..	..	..	1	..	6,500	1	..	..
n	138	142	137	151	155	168	176	196	157	191
Average	633	613	673	855	1,058	1,159	1,261	1,286	1,310	1,138
Median	570	550	600	760	890	1,010	1,040	1,070	1,070	975

[1] The records for 1866 also were not available, but the records for 1865 and for 1867 were; and the average of these for any parish may be taken as a close approximation to the facts for 1866.

distributions, counting those in each class interval as at its mid-point. The medians are computed also from these distributions, counting those in each class interval as distributed evenly throughout it. Neither of these procedures is exact, since the salaries are more often at, say, $900 and $950 than at $948 and $998. The error is, however, small, since irregular amounts for salaries are rather common in the

TABLE II

MEDIAN AND AVERAGE SALARIES* OF TWO GROUPS OF METHODIST CLERGYMEN, BY TWO-YEAR PERIODS, 1860 TO 1924

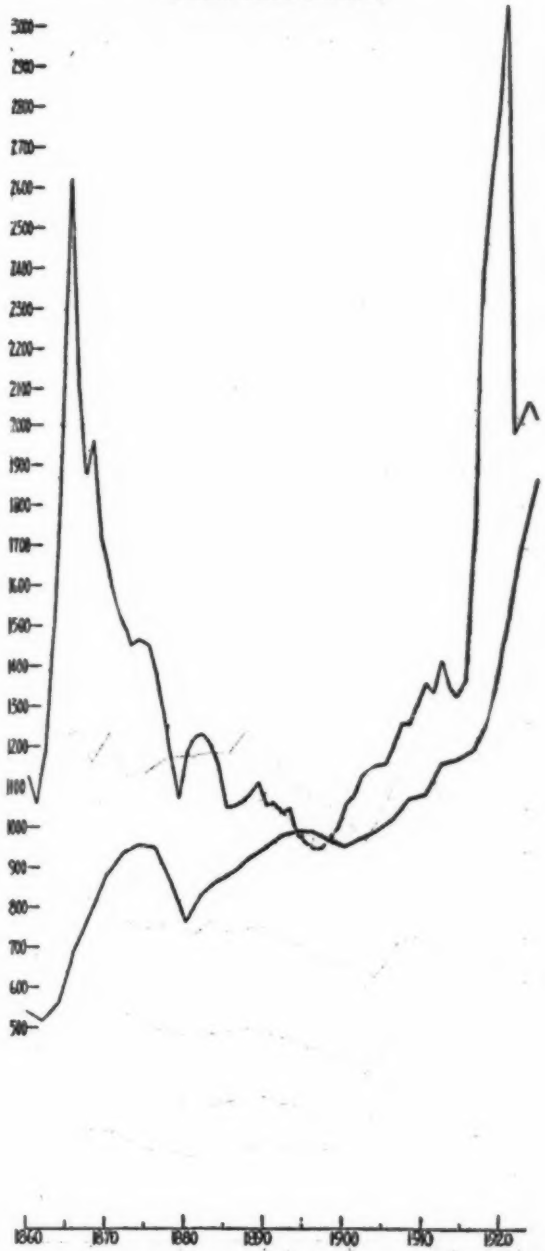
Year	Medians		Averages	
	New England	New York	New England	New York
1860	570	...	633	...
1862	550	490	613	585
1864	600	530	673	621
1866	760	630	855	769
1868	890	680	1,058	864
1870	1,010	760	1,159	952
1872	1,040	830	1,261	1,074
1874	1,070	840	1,286	1,050
1876	1,070	830	1,310	1,067
1878	975	760	1,138	972
1880	840	690	1,023	910
1882	875	790	1,038	1,062
1884	890	840	1,063	1,101
1886	950	830	1,083	1,102
1888	1,010	840	1,130	1,143
1890	1,000	900	1,136	1,177
1892	1,070	890	1,244	1,201
1894	1,070	910	1,299	1,257
1896	1,040	930	1,146	1,250
1898	1,040	890	1,180	1,221
1900	1,010	890	1,147	1,220
1902	1,030	910	1,140	1,289
1904	1,030	950	1,132	1,283
1906	1,040	1,000	1,151	1,238
1908	1,110	1,030	1,199	1,262
1910	1,090	1,070	1,211	1,371
1912	1,200	1,090	1,252	1,355
1914	1,170	1,160	1,290	1,404
1916	1,230	1,140	1,317	1,450
1918	1,310	1,220	1,424	1,458
1920	1,600	1,340	1,675	1,546
1922	1,810	1,590	1,927	1,833
1924	1,920	1,810	2,024	2,122

* A house is furnished in addition to the salary entered here. Its value is approximately 25 per cent of the salary entered here.

records; it is also of little consequence for our general purpose. It acts to make all the averages and medians about $30 too high. We should have recorded the salaries to the nearest dollar if we had foreseen that the present use would be made of them. We also suspect that the salary of $6500 recorded in 1872 is in error, but cannot justify our suspicion.

CHART I

THE CURVE OF THE COST OF COMMODITIES (ABOVE) AND THE CURVE OF MEDIAN SALARY, EXCLUSIVE OF THE RENTAL VALUES OF THE PARSONAGE. (BELOW) *



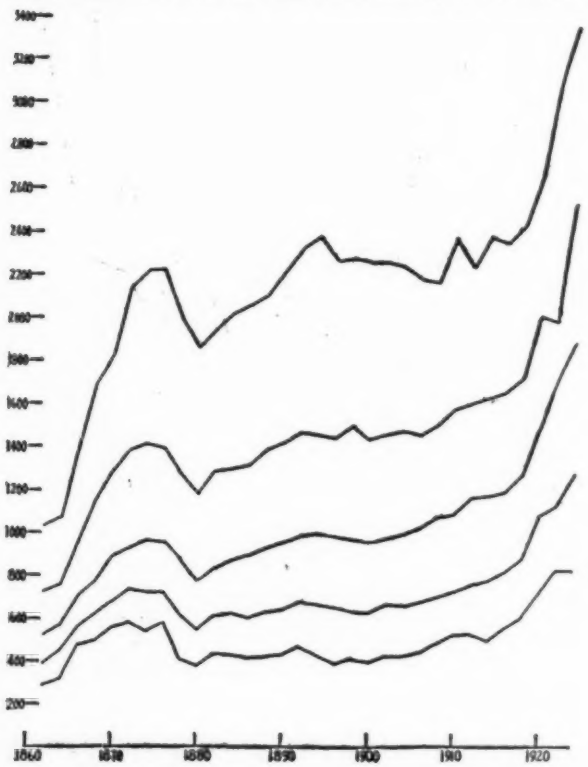
* The last zero of the scale is discarded to give the King index number. The scale gives the salary in dollars.

From tables like Table I, Table II is derived. The columns of medians are worthy of especial attention since any errors in the records or in our interpretation of them will, for any year, have almost zero influence upon the median. The best single measure to use is the average of the two medians. The graph of this is shown in Chart I, together with a graph of the general cost of commodities.

The graph of the cost of commodities uses the estimates of King (The Wealth and Income of the People of the United States, pages 189 and 190) from 1860 to 1912, and the estimates of the U. S. Department of Labor (Bureau of Labor Statistics, Bulletin No. 390, pages 8 and 9) from 1913 to 1924. The latter, which use 1913 as a base, are multiplied by 135 to put them on the same approximate base as King's estimates. In interpreting the graph, allowance should be made for the fact that the salary year in the two conferences used runs from about March to

CHART II

THE CURVES OF 10-PERCENTILE, 25-PERCENTILE, 50-PERCENTILE, 75-PERCENTILE, AND 90-PERCENTILE SALARIES, EXCLUSIVE OF THE RENTAL VALUE OF THE PARSONAGE, IN DOLLARS



March, the year 1895, for example, being from March, 1895, to March, 1896, or three months later than the calendar year 1895. The differences between the causation of the rise of prices in the 60's and the causation of the rise of 1915 to 1920 need not be discussed here.

The graph tells the story better than words can. The salaries rose and fell only by a fraction of what prices rose and fell, and with a notable lag. The rise of 1863, '64, and '65, with its acme at '65, is paralleled by the conference years '65, '66, '67, '68, '69, and '70. Prices rose in these years to two and a quarter times what they were. Salaries rose in six years only to a little over one and a half times what

CHART III

THE FACTS OF CHART II, EACH POINT OF EACH CURVE BEING THE PER CENT WHICH THE HEIGHT OF THE CORRESPONDING POINT OF CHART II IS OF THE AVERAGE HEIGHT OF THE POINTS ON THAT CURVE FOR YEARS 1890 TO 1908, INCLUSIVE

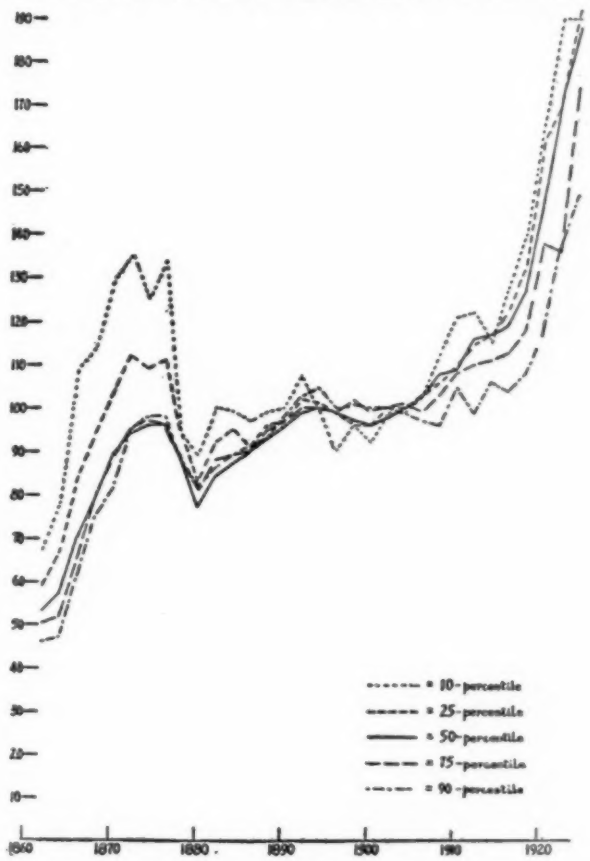


TABLE III

THE 10-PERCENTILE, 25-PERCENTILE, MEDIAN, 75-PERCENTILE AND 90-PERCENTILE SALARIES, FROM 1862 TO 1924, EXPRESSED IN EACH CASE AS A PER CENT OF THE AVERAGE SALARY FROM 1890 TO 1908

Year	Salary				
	10 percentile	25 percentile	Median	75 percentile	90 percentile
1862	67	59	53	50	46
64	78	67	57	52	47
66	109	84	70	65	61
68	114	95	79	79	75
70	129	103	89	88	81
72	135	112	94	95	95
74	125	109	96	97	98
76	134	110	96	96	98
78	94	94	88	87	88
80	89	83	77	81	82
82	100	92	84	88	86
84	99	95	87	89	89
86	97	91	90	90	91
88	98	96	93	95	93
90	100	97	96	97	98
92	108	102	99	100	103
94	100	101	100	100	105
96	90	99	99	99	100
98	96	96	97	102	101
1900	92	96	96	99	100
02	99	100	98	100	100
04	99	100	100	101	99
06	103	103	103	99	97
08	113	106	108	103	96
10	121	110	109	108	105
12	122	115	116	110	99
14	115	117	117	111	106
16	128	123	119	113	104
18	140	133	127	118	108
20	166	162	148	138	117
22	190	170	172	136	137
24	190	192	188	174	149

they were. Prices fell back to the level of 1862 in eleven years, nearly half of the fall occurring in '66 and '67. The effect of the drop on salaries was, in combination with other tendencies acting on them, such as to slow down the rate of rise for four years, hold salaries stationary for two years, and make them fall less than halfway back to the level of '60 and '64 in the next four years.

The rise of over 120 per cent in prices in 1916, '17, '18, '19, and '20 is paralleled by a rise of salaries of about 55 per cent in the conference years 1919, '20, '21, '22, '23, and '24, which seems likely to continue further. The fall of a third in prices in 1921 had not produced any effect on the median salaries by 1924.

In order to treat the effect of the two economic cataclysms and the more moderate fall and rise from 1880 to 1915 on these ministers' salaries adequately, one needs to have some idea of what would have happened to the salaries if prices had been stable from 1860 to 1924. Such an idea should be based on general knowledge of the salary changes in other professions, on a consideration of the part of our curve

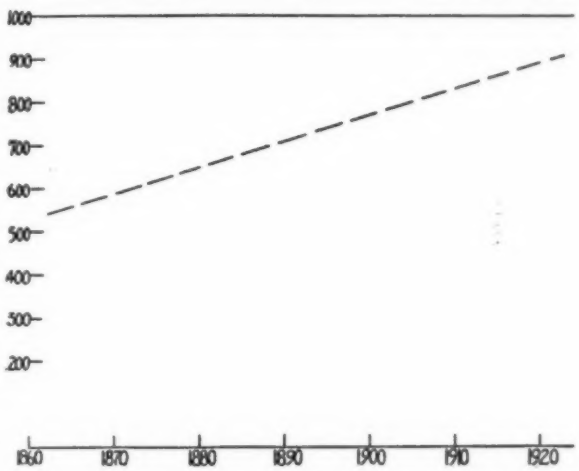
between 1885 and 1914, when general prices changed relatively little and steadily, and on knowledge of the special history of the Methodist clergymen in Massachusetts and Eastern New York during the period from 1860 to 1924. In connection with the latter, it may be noted here that up to 1860 competition in salaries was not allowed, each minister receiving a fixed allowance governed in amount by the size of his family and other considerations.

We have computed also the course of each of the following from 1860 to 1924: the salary reached or exceeded by 10 per cent of the men, the salary reached or exceeded by 25 per cent, the salary reached or exceeded by 75 per cent, and the salary reached or exceeded by 90 per cent.

The gross changes are shown by the five graphs of Chart II. Table III and Chart III show the facts when each salary is expressed as a per

CHART IV

ESTIMATED CURVE OF MEDIAN SALARY (DASH LINE) IF THE COST OF COMMODITIES HAD REMAINED UNCHANGED FROM 1860 TO 1920



cent of the average of the 1890 to 1908 salaries for the percentile in question.

The changes with time are of the same general nature in all, but are complicated somewhat by the fact that with time there are more high salaries added than there are low salaries dropped, and by the unreliability of the determinations of the 10 percentiles and 90 percentiles. There is probably some differential action of changes in the purchasing power of money upon high and low salaries, apparently in the way of a greater susceptibility of the latter.

Most of the readers of this JOURNAL will be able to estimate the salary change, if prices had been stable at their 1860 level of 112.7, better than we. But for those who are not, a very rough estimate is given in the dash line of Chart IV. By any reasonable estimate we think it will remain true that these salaries rose more as a result of the sudden rises of prices in the sixties and late 'teens than that they fell as a result of the equivalent drop of '65 to '80, or will lose from the drop of 1921 or from any continuation of it which may come in the next five years. It is interesting to reflect on the chain of causes whereby these ministers of the gospel apparently profited by violent price fluctuations originally caused in both cases by war.

THE CALCULATION OF MOMENTS ABOUT THE MEAN AS ORIGIN

By J. Arthur Harris, *Department of Botany, University of Minnesota*

In his fundamental paper on the systematic fitting of curves[1] Karl Pearson showed that if μ_n be the nth moment coefficient of the frequency distribution $y=f(x)$ about its mean, and μ_n' be the nth moment coefficient of the frequency about any other abscissa, the values of μ_1 to μ_6 are:

$$\mu_1=0$$
$$\mu_2=\mu_2'-\mu_1'^2$$
$$\mu_3=\mu_3'-3\mu_1'\mu_2'+2\mu_1'^3$$
$$\mu_4=\mu_4'-4\mu_1'\mu_3'+6\mu_1'^2\mu_2'-3\mu_1'^4$$
$$\mu_5=\mu_5'-5\mu_1'\mu_4'+10\mu_1'^2\mu_3'-10\mu_1'^3\mu_2'+4\mu_1'^5$$
$$\mu_6=\mu_6'-6\mu_1'\mu_5'+15\mu_1'^2\mu_4'-20\mu_1'^3\mu_3'+15\mu_1'^4\mu_2'-5\mu_1'^6$$

These or similar relations have also been discussed by Hardy[2] and by Elderton.[3]

In the early history of the development of modern higher statistics the limited mechanical equipment available made it desirable to take moments about an arbitrary origin so selected as to lighten the labor of arithmetical calculation. Pearson's series of equations make such a procedure possible.

In these days of highly perfected and generally available mechanical computing equipment it becomes most practicable to deal with moments about 0 as origin. This permits (a) the wider use of mechanical computing equipment, and (b) the organization of the routine work in such a manner as to attain the maximum number of end results and provide the maximum of checks for the work, with the minimum of arithmetical effort. An effort has, therefore, been made to write the formulae required in biometric work in terms of moments about 0 as origin. The formula for the calculation of the product-moment correlation coefficient was the first to be written in such terms.[4] Moments about 0 as origin furnished the basis for suggestions concerning the

[1] Pearson, Karl, "On the Systematic Fitting of Curves to Observations and Measurements," *Biometrika* 1: 265–303, 1902.

[2] Hardy, G. H., *The Theory of the Construction of Tables of Mortality and of Similar Statistical Tables in Use by the Actuary*, London, 1909.

[3] Elderton, W. P., *Frequency Curves and Correlations*, London, 1906.

[4] Harris, J. Arthur, *American Nat.* 44: 693–699, 1910. When this paper was written I was not aware that Macdonell had used (p. 231) the same formula for the product-moment coefficient in a craniometric investigation published six years earlier. See W. R. Macdonell, *Biometrika* 3: 231, 1904.

formation of correlation and contingency tables and of condensed correlation tables[1] for cases involving a large number of possible combinations. These were followed by the development of a fairly complete system of formulae for the calculation of intra-class and inter-class coefficients from class moments under similar conditions[2] and by the suggestion of a substratum heterogeneity coefficient[3] which has been extensively applied. The possibility of spurious correlation due to disorderly differentiation in the use of such formulae was early recognized.[4]

Formulae in terms of moments about 0 as origin for the calculation of the correlation between growth increments have been developed,[5] illustrated,[6] and utilized in determining the probable error of the difference between differences.[7]

The correlation between a component, and between the sum of two or more components, and the sum of the remaining components of a variable have also been given[8] in terms of moments about 0 as origin.

The method of moments about 0 as origin was utilized in determining the standard deviation of the deviation of a dependent variable from its probable value and its regression on an independent variable.[9] It has also been used in determining the correlation between a variable and the deviation of an associated but not dependent variable from its probable value.[10]

It now seems desirable to indicate methods for determining the higher moments about the mean from rough moments about 0 as origin.

Let $\Sigma(x-\bar{x}), \Sigma[(x-\bar{x})^2], \Sigma[(x-\bar{x})^3], \ldots, \Sigma[(x-\bar{x})^n]$
be the first n moments for a frequency distribution of N individuals about the true mean, $\bar{x}$, as origin.

The ratios of these values to N conventionally designated as μ_1, μ_2, μ_3, . . . , μ_n, are the first n moment coefficients.

Now the moments about 0 as origin are given at once symbolically by the successive powers of $(x-\bar{x})$ as determined by the binomial theorum, e. g.,

$$\Sigma(x-\bar{x}) = 0$$
$$\Sigma[(x-\bar{x})^2] = \Sigma(x^2) - 2\Sigma(x\bar{x}) + \Sigma(\bar{x}^2)$$

[1] Harris, J. Arthur, *ibid.* 45: 566–571, 1911; and 46: 477–486, 1912.
[2] Harris, J. Arthur, *Biometrika* 9: 446–472, 1913.
[3] Harris, J. Arthur, *American Nat.* 49: 430–454, 1915.
[4] Harris, J. Arthur, *Biometrika*, 10: 412–416, 1914.
[5] Harris, J. Arthur, *Proceedings of the Society for Experimental Biology and Medicine* 18: 4–5, 1921.
[6] Harris, J. Arthur, and H. S. Reed, *Biological Bulletin* 40: 243–258, 1921.
[7] Harris, J. Arthur, this JOURNAL, 18: 514, 1922.
[8] Harris, J. Arthur, this JOURNAL, 15: 854–859, 1917.
[9] Harris, J. Arthur, *Genetics*, 3: 328–352, 1918.
[10] Harris, J. Arthur, this JOURNAL, 18: 393–394, 1922.

			$=\Sigma[(x-\bar{x})^2]$	$=\Sigma[(x-\bar{x})^3]$	$=\Sigma[(x-\bar{x})^4]$	$=\Sigma[(x-\bar{x})^5]$	$=\Sigma[(x-\bar{x})^6]$	
		$-N\bar{x}$	$+N\bar{x}^2$	$-N\bar{x}^3$	$+N\bar{x}^4$	$-N\bar{x}^5$	$+N\bar{x}^6$	
	$\Sigma(x)$ +	$-2\bar{x}\Sigma(x)$	$+3\bar{x}^2\Sigma(x)$	$-4\bar{x}^3\Sigma(x)$	$+5\bar{x}^4\Sigma(x)$	$-6\bar{x}^5\Sigma(x)$		
	$\Sigma(x^2)$ +	$-3\bar{x}\Sigma(x^2)$	$+6\bar{x}^2\Sigma(x^2)$	$-10\bar{x}^3\Sigma(x^2)$	$+15\bar{x}^4\Sigma(x^2)$			
	$\Sigma(x^3)$ +	$-4\bar{x}\Sigma(x^3)$	$+10\bar{x}^2\Sigma(x^3)$	$-20\bar{x}^3\Sigma(x^3)$				
	$\Sigma(x^4)$ +	$-5\bar{x}\Sigma(x^4)$	$+15\bar{x}^2\Sigma(x^4)$					
	$\Sigma(x^5)$ +	$-6\bar{x}\Sigma(x^5)$						
	$\Sigma(x^6)$ +							
		$\bar{x}$ (−)	$\bar{x}^2$ (+)	$\bar{x}^3$ (−)	$\bar{x}^4$ (+)	$\bar{x}^5$ (−)	$\bar{x}^6$ (+)	

Arrangement of powers of the mean value of x and the first six moments of x about 0 as origin for the calculation of higher moment coefficients about the mean as origin.

$$\Sigma[(x-\bar{x})^3]=\Sigma(x^3)-3\Sigma(x^2\bar{x})+3\Sigma(x\bar{x}^2)-\Sigma(\bar{x}^3)$$
$$\Sigma[(x-\bar{x})^4]=\Sigma(x^4)-4\Sigma(x^3\bar{x})+6\Sigma(x^2\bar{x}^2)-4\Sigma(x\bar{x}^3)+\Sigma(\bar{x}^4),$$

and so on, when more than the fourth moment is required.

Noting that $\bar{x}=\Sigma(x)/N$ is a constant, we may write

$$\Sigma[(x-x)^2]=\Sigma(x^2)-2\bar{x}\Sigma(x)+N\bar{x}^2$$
$$\Sigma[(x-\bar{x})^3]=\Sigma(x^3)-3\bar{x}\Sigma(x^2)+3\bar{x}^2\Sigma(x)-N\bar{x}^3$$
$$\Sigma[(x-\bar{x})^4]=\Sigma(x^4)-4\bar{x}\Sigma(x^3)+6\bar{x}^2\Sigma(x^2)-4\bar{x}^3\Sigma(x)+N\bar{x}^4,$$

and similarly for higher moments. This reduces the whole labor of calculation to terms of the various moments of x about 0 as origin, of the powers of $\bar{x}$, and of the products of various powers of the mean and of $n-1$ of the moments of x about 0 as origin.

These products may be most readily determined systematically by entering both the several moments of x and the powers of $\bar{x}$ as marginal values in a table of double entry. The marginal value of $\Sigma(x^n)$ gives the first term, while $N\bar{x}^n$ gives the final term of $\Sigma[(x-\bar{x})^n]$. All other terms may be obtained in a few minutes by machine multiplication by modification. The arrangement of the table is such that the summation of the several diagonal cells gives the required moments of x about the true mean.

The extreme simplicity of the whole process will be clear from the accompanying diagram.

INFANT MORTALITY AND THE BUSINESS CYCLE

I

Apropos of the positive correlation found between an increase in prosperity and an increase in the infant mortality rate in Miss Thomas's study of the *Social Aspects of the Business Cycle*, may I suggest that it by no means follows that increased prosperity necessarily signifies an increase in the average economic status of families in which births occur. If in times of prosperity births occur preponderantly in families of lower economic status, it is quite possible that the average economic position of families in which infants are born may actually be lower in times of prosperity than in times of depression. In other words, this relation between prosperity and infant mortality may be simply another example of those familiar statistical paradoxes where variables in prevalence and variables in causation are involved simultaneously.

This leads to the further suggestion that the need is not for the application of more "partial correlation," which is in general inappropriate to the analysis of this type of problem, but for data with which to determine the actual factors at work, to trace their effects, and to measure their importance. For example, if marriages are postponed by the unemployed, by workers in the lower and in the higher economic strata during periods of depression, how numerous are they and what effect would they have upon the birth-rate when they are consummated on the upswing of the prosperity cycle? Are births in these different groups actually postponed during periods of depression and, if so, in what numbers? Are births actually increased in these groups during periods of returning prosperity, and, if so, at what stage of the cycle? The problem is thus seen to be very complex, and its solution requires data that help to measure the specific factors at work.

To the possibility that increased prosperity may be accompanied by an increased prevalence of artificial feeding and that this may contribute to increased mortality, I am disposed to give much greater weight than does Professor Hankins in his review of Miss Thomas's book, published in the September number of this JOURNAL. The conclusion of the Galton Laboratory upon which he relies is so at variance with the modern teaching and practice of physicians and infant welfare specialists that it could be accepted only if supported by the most trustworthy evidence analyzed by the most significant methods.

If the statement that "the Galton Laboratory studies . . . also showed that bottle feeding is an almost negligible factor when account is taken of the physique and intelligence of the mother" means that increased *prevalence* of artificial feeding is correlative with weaker physique or lesser intelligence of the mother and that these correlated factors explain the increased mortality found associated with artificial feeding, it appears to be inapplicable to the present problem. For it does not throw any light upon whether or not a change from breast to artificial feeding, independent of the mother's health or intelligence, will increase infant mortality. In other words, it does not throw light upon the causal influence of feeding upon mortality. The Galton Laboratory, so far as I am aware, has

never analyzed data on infant feeding and mortality by the methods required to show the true *causal* relationship. This analysis requires as a first step that deaths be compared to the time exposed to risk and that both be classified by type of feeding.

But other evidence is available which bears specifically upon the problem. The analysis of the data on feeding gathered by the United States Children's Bureau (see the writer's *Causal Factors in Infant Mortality*, Children's Bureau Publication No. 142, and also *Infant Mortality and Its Causes*, Chapter V), in which deaths were compared to exposure classified according to types of feeding, indicated a markedly increased mortality associated with artificial feeding. Special attention should be directed to the evidence which showed a tendency for infants transferred from breast to artificial feeding during the early months of life to be subject to an increasing mortality during the months immediately following the change. This is, of course, directly contrary to the general tendency for the rate to fall with increasing age during infancy. Convincing indirect evidence of the importance of a change in feeding is found in the decreased infant mortality experienced in Paris during the siege and in Lancashire during periods of industrial unemployment — a decrease attributed to the increase in breast feeding necessitated by the environing conditions.

But to return to the business cycle, definite evidence is needed to show whether in times of prosperity there is actually any considerable increase in artificial feeding and, if so, whether it would adequately account for the increased mortality.

There remains, of course, the possibility that after all possible explanations are tested the correlation between prosperity and increased infant mortality may have to be set down as one of those "nonsense" correlations which Mr. Yule has so brilliantly described in the January, 1926, number of the *Journal of the Royal Statistical Society*.

ROBERT M. WOODBURY

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II

I am not at all disposed to take exception to most of what Dr. Woodbury has said. I am certainly far from saying that artificial feeding has nothing to do with infant mortality. It does seem to me, however, that Dr. Woodbury takes great pains to prove the substance of the quotation from my review to which he appears to be taking exception. That quotation did not say that artificial feeding was of no significance, but that it was of less importance than the physique and intelligence of the mother. Both he and I then argue that, if the lower grade mothers are more likely than others to lose their jobs when business declines, and if marriages and births are less frequent proportionately among individuals of low physique and intelligence during such periods, and if the reverse conditions prevail with an upswing of prosperity, then the inverse correlation of infant mortality and business finds some explanation. He finds this explanation in the increased tendency of the mothers to nurse their infants during periods of de-

pression. I do not doubt this is a factor; but on the whole I consider it less significant from the standpoint of social philosophy than the quality of the parents, which Pearson finds to be more intensely associated with infant mortality than the method of feeding. No doubt the whole matter needs further investigation, but Dr. Woodbury is wholly mistaken if he thinks the matter has been exhausted when we find that artificial feeding is a factor. This may be taken for granted. Intelligent and sensitive mothers will, however, preserve a greater proportion of their offspring with artificial feeding than ignorant and indifferent ones with breast feeding. There are a great many ways in which infants can be destroyed besides feeding them out of a bottle.

Moreover, when Dr. Woodbury says that the correlation method is not a suitable method, I should be disposed to say that it is the only method whereby the relative weights of different factors can be made clear. It has been shown that such conditions as housing, wages of the father and numerous other environmental factors are "causes" of infant mortality, and I know of no one who doubts them. But if we find that the physique and intelligence of the mother is associated with infant mortality many more times as closely as the method of feeding, then we may say that, while method of feeding is itself a "cause," much of its apparent importance is attributable to the physical and mental qualities of the mother which make the artificial method necessary or desirable. Similarly, we should like to know how much of the correlation between low wages of the father and infant mortality can be attributed to the fact that low wages are closely associated with physical and mental traits. It is rather unfortunate that the Children's Bureau investigations, praiseworthy as they undoubtedly are, could not have given more attention to such correlations, and perhaps less to phases of the subject which appeal more directly to humane sentiments.

F. H. Hankins

Smith College

PROGRESS OF WORK IN THE CENSUS BUREAU

CENSUS OF MIAMI

By request of the city government a special census of Miami, Florida, was taken as of December 6, 1926, under the supervision of a representative of the Bureau of the Census. It showed a population of 131,286 as against a population of 29,571 in 1920.

The work of enumeration was done by volunteer enumerators furnished by the different luncheon and service clubs of the city. The city was divided in 16 census sections, each in charge of a representative of one of the clubs; and there were about 250 enumerators engaged in the work.

In addition to the questions usually asked at special censuses, inquiries concerning former residence, tenure of homes, occupation, and class of worker were added. All of the tabulations were made at Miami by means of hand tallies, adding machines, and comptometers; and the results were announced on December 23, or 16 days after the date of the census.

It is of some interest to note that 81 per cent of the total population of the city were formerly residents of states other than Florida.

MANUAL OF CRIMINAL STATISTICS

In connection with the annual census of prisons and reformatories, which has recently been inaugurated by the Census Bureau, a manual of 64 pages, entitled "Instructions for Compiling Criminal Statistics," has been issued by the Bureau. In addition to instructions for making out the reports for the annual census of prisons and reformatories, the manual contains suggestions as to the statistics which should be compiled by jails and workhouses, police departments, courts, prosecutors, and parole and probation agencies, together with suggested table forms for such statistics. A standard record card for prisons and reformatories is also suggested. It is hoped that the manual may help to standardize and improve the state and local current statistics of crime and criminals in the United States.

EXTENSION OF BIRTH REGISTRATION

The state of Idaho was recently admitted to the birth registration area. The area now includes 35 states and comprises 76.8 per cent of the estimated total population of continental United States, while the death registration area includes 41 states and comprises 89.8 per cent of the population.

SESQUICENTENNIAL EXHIBIT

The Census Bureau's exhibit of maps, diagrams, etc., at the Sesquicentennial, including the electrical mechanism for indicating by colored flashlights the current movement of population, as described in the June (1926) issue of this JOURNAL, will be reproduced in about the same form as that shown at Philadelphia and kept as a permanent exhibit in the building occupied by the Bureau in Washington.

J. A. H.

MISCELLANEOUS NOTES

Dinner Meeting of the Washington Statistical Society.—The first fall meeting of the Washington Statistical Society was a dinner meeting held at the Grace Dodge Hotel on the evening of November 5. The general subject of the meeting was "The Recent Census of Agriculture," and papers were presented by William L. Austin and Leon E. Truesdell, of the Bureau of the Census, and by Lewis C. Gray, of the Bureau of Agricultural Economics. Dr. Joseph A. Hill, President of the Society, presided, and the discussion was opened by Dr. William M. Steuart, Director of the Census.

Dr. Hill called the meeting to order and then outlined the history of the Washington Statistical Society which was launched as a branch of the American Statistical Association at a meeting held last January. The constitution adopted at the January meeting was read so that all who had not attended the prior meeting might know its contents. Dr. Hill outlined briefly the future plans of the Society, which were received with enthusiasm by the 61 members present.

Mr. William L. Austin, the first speaker, discussed "The Organization of the Census." He emphasized the importance of the first inter-decennial census of

agriculture and sketched the magnitude of the undertaking. The census covered some 6,500,000 farms; required the employment of 26,000 workers, and cost approximately $3,500,000. Tabulating the returns kept 398 punching machines busy and 96,000,000 cards were punched.

Mr. Leon E. Truesdell described "The Census Schedule." A joint committee of the Department of Agriculture and the Bureau of the Census, aided by the Census Advisory Committee of the American Statistical Association, passed upon a list of 500 questions. This total was reduced to 178 inquiries which were incorporated in the final schedule. Ten million copies of the schedule were printed.

Dr. Lewis C. Gray next discussed "Some Results of the Census." He pointed out the immense value of the information gathered in showing extensive changes in the demand for agricultural products, in the geographic distribution of agricultural production, and in changes in industrial technique. He showed the influence of urban expansion upon agricultural production, how character of demand and distribution of crop-growing areas are affected. He pointed to decreased per capita consumption of flour, cotton, corn, etc., and to increases in consumption of live stock products. There was an increase of 13 per cent in the number of chickens—particularly in the vicinity of large cities. Displacement of horses and mules by motors continues and there was an increase of 110 per cent in the number of farm tractors. There was a decrease in agricultural acreage in the East, and throughout the country there was a total decrease of about 77,000 in the number of farms.

Dr. William M. Steuart told of some of the difficulties in the administration of the agricultural census, stating that it would not be possible to publish all the material obtained with the funds now available. He emphasized the importance of the agricultural census as an example of successful coöperation between two great divisions of the federal government and predicted that the information thus obtained would be of greatest value to the country as a whole.

San Francisco Chapter of the American Statistical Association.—On Friday evening, November 12, 1926, the second Dinner Meeting of the San Francisco Chapter of the American Statistical Association was held at the Commercial Club, Merchants' Exchange, San Francisco, with Mr. A. H. Mowbray of the University of California as Chairman. The topic for discussion was "Statistics and Budgetary Control," and the speakers of the evening were Mr. Joyce Kelly, of the Metropolitan Life Insurance Company, Mr. C. L. Queen, of A. Schilling and Company, and Mr. N. J. Silberling, of the University of California.

Mr. Mowbray opened by giving a brief talk on the benefits of the Association. It was moved and carried that the Chairman appoint a committee to form the organization of the San Francisco Chapter of the Association.

Mr. Kelly was introduced as the first speaker of the evening. He discussed the question of statistics as related to budgetary control and how budgetary procedure is carried out in progressive concerns. He elaborated on systems adapted to the needs of a typical manufacturing concern, with mention of the production estimate, sales estimate, financial estimate and the Controller's function of combining these estimates and coördinating policies.

Mr. Queen, the second speaker of the evening, described budgetary control as carried out in the A. Schilling Company, emphasizing the need for systematic basic records and the elimination of a mass of charts by use of columnar records. He stated that economic conditions have changed, making budgetary control more and more necessary. He referred to such changes as supply making demand, forward-looking

attitude on the part of business men, changed type of competition due to mass production and transportation facilities. Company records should be *used*, not merely filed away.

Mr. Silberling was the third speaker. He brought out the relation between budgeting and the expediting of business; how business of today is working more on a basis of small inventories and quick turnover resulting in the increased need for budgeting. He referred to the need for coöperation between production and sales departments; an attitude on the part of executives to face the facts; the opportunity for correcting future conditions; building up of master forecasts from regional forecasts. He also discussed the trend factor, seasonal factor, cycle factor, price factor, and internal factors of policy. In concluding, Mr. Silberling referred to a new idea of Mr. Barber, of the Walworth Company, who was able to obtain figures from companies in his line of business and constructed a pooled index of orders which has important forecasting value for all concerns in that field.

Following this there was a general discussion from the floor during which it was brought out by Mr. Working, of Stanford University, that the food industries do not always tie in with the business cycle, but are subject to special factors.

The Chairman then appointed the committee on organization: Mr. Bachelor of the Pacific Telephone and Telegraph Company, Mr. Silberling of the University of California, and Mr. Working of Stanford University.

The meeting adjourned at 9.40 P. M.

Cleveland Business Statistics Discussion Group.—Last June several Cleveland members of the American Statistical Association organized a business statistics discussion group to meet once a month for the purpose of discussing general business conditions and the use of statistics in analyzing business problems. Membership in this group is limited, but includes at least one representative from practically every important business and industrial activity in Cleveland.

A program committee of five members is charged with arranging the program in advance of the regular meeting. In order to unify the discussion certain generally accepted indexes were decided upon to indicate the fluctuations in general business, or to measure the changes in commodity prices or interest rates; and the interesting feature has been that the group has undertaken to forecast the future trend of these indexes. Each member presents his forecast of the future and these individual estimates are then averaged to make up the group estimate. The latter estimate is then compared with the actual data as such data are made available.

Future meetings of this group will carry on this forecasting feature, and it is hoped that every third or fourth meeting can be devoted to a discussion of the problems which confront the individual members or to a presentation of some piece of research which a member has completed. Mr. J. D. M. Phillips of the National Association of Steel Furniture Manufacturers is President of this organization.

Meeting of Business Statistics Section of the Ohio Conference of Statisticians.—There was organized last April at Columbus an organization known as the Ohio Conference of Statisticians to appeal to all those in the state who are interested in statistical research. The officers are: E. O. Merchant, Dayton, President; Harry S. Will, Columbus, Vice-President; and Ralph J. Watkins, Columbus, Secretary-Treasurer. The constitution provides for the organization of special sections devoted to particular phases of statistical research. A Business Statistics Section has recently been formed under the chairmanship of Spurgeon Bell, Director of the Bureau of Business Research of the Ohio State University.

Arrangement was made with the Management Week Committee of the Ohio State University by which the program of the Business Statistics Section was adopted as a section of the Management Week Program of the Ohio State University. The meetings were held on the campus at Columbus, October 28, 1926.

The speakers at the morning session were C. O. Hardy of the Institute of Economics, Washington, and B. B. Smith of the White Motor Company, Cleveland. Mr. Hardy in his paper, "An Analysis of Some Current Methods of Forecasting the Trend of Business," presented a summary of his analysis of the methods of forecasting now in use by the various economic services as presented in his forthcoming volume on this subject.

The title of Mr. Smith's paper was "The Use of Interest Rates and Prices in Forecasting Business." Mr. Smith presented the technique involved and the results secured in his use of the methods of curvilinear multiple correlation in forecasting the percentage of blast furnaces in operation twelve months ahead. Five independent variables were used in the study.

The afternoon session was devoted to two papers concerning the forecasting of trade trends. Ralph J. Watkins of the Bureau of Business Research of the Ohio State University read a paper on the relationship between industrial employment and department store sales in Ohio. C. C. Morris of the Department of Mathematics of the Ohio State University discussed the mathematics involved in his work in forecasting wholesale trade in the United States.

The evening session was a dinner meeting at the Faculty Club on the campus, and this meeting was open to all groups attending Management Week sessions. Carl Snyder of the Federal Reserve Bank of New York presented a paper on "Recent Advance in Economic Science in the Study of Price Trends." Mr. Snyder presented the results of his study in the representation of the fluctuations in the volume of business and prices.

The papers presented at these meetings will be available in the "Proceedings of Management Week" to be published soon by the Bureau of Business Research.

United States Bureau of Labor Statistics.—Field investigations not previously reported have been started on the following subjects: Productivity of labor and comparison of hand and machine labor costs in the printing industry, among harbor workers and in the rubber tire industry; wages and hours of labor in the bituminous coal industry; apprenticeship in the building trades. The field work on outdoor recreation and welfare work for industrial employees has been completed and the final report is being prepared.

Other studies now under way and nearing completion are: Mexican colonies in the United States; development of the coöperative movement in the United States; and wages and hours in the iron and steel, textile, men's clothing, boot and shoe and hosiery and underwear industries.

On October 4, President Leonard P. Ayres addressed the Los Angeles Chapter of the American Statistical Association. His subject dealt with problems of business forecasting and the national outlook for 1927. About 25 members and guests were present. After the address President Ayres answered questions of those present in regard to various problems of business forecasting. On December 7, he talked to the Washington group of the American Statistical Association and discussed the prospects for general business in 1927. There was a good attendance under the chairmanship of Dr. Joseph A. Hill of the Census Bureau. During the past year President Ayres

has also spoken at sectional meetings of the Association at Cleveland, Columbus, Detroit, New York, and Boston.

Professor Robert E. Chaddock, at the Summer Session of Columbia University, will conduct a round table discussion course on methods for teachers of elementary statistics. The function of training in quantitative methods, the order in which various topics should be presented to beginners, the content and treatment of materials for instruction, the procedures and equipment for practice work in statistics, the most useful sources of statistical data will be considered.

The course by Dr. Carl Snyder in the Summer Session of Columbia University, entitled "Business Cycles and Business Measurements," will this year include a full review of the methods and results of business forecasting.

Dr. W. H. Steiner has been appointed Associate Professor of Economics in the College of the City of New York.

On November 17, Mr. Dorsey W. Hyde, Jr., resigned from the Chamber of Commerce of the United States to accept appointment as Secretary of the Chamber of Commerce of Washington, D. C.

Professor H. L. Rietz of the University of Iowa is Actuary of the Pension Commission of the City of Chicago, which is charged with studying the operation of the pension funds for the public employees of the city.

The two Americans elected in September to membership in the Institut International de Statistique, which has its headquarters at the Hague, were Professor Irving Fisher, of Yale University, and Mr. William H. Davis, of the Bureau of the Census.

At the meeting of the Executive Committee of the Stable Money Association, October 15, Mr. Edwin W. Kopf, Assistant Statistician of the Metropolitan Life Insurance Company, was elected Secretary of the Association.

MEMBERS ADDED SINCE DECEMBER, 1926

Alexander, Sterling J., Southwestern Bell Telephone Company, St. Louis, Mo.

Alexander, Mary Louise, Barton, Durstine and Osborn, Advertising Agency, 383 Madison Avenue, New York, N. Y.

Bagwell, Gertrude, National Council on Compensation Insurance, 151 Fifth Avenue, New York, N. Y.

Baridon, Felix E., Personnel Research, Western Electric Company, 195 Broadway, New York, N. Y.

Bell, James Christy, Security Analysis, James B. Colgate and Company, 17 East 42 Street, New York, N. Y.

Berry, Madeline, Social Statistics, Indianapolis Community Fund, Old Chamber of Commerce Building, Indianapolis, Ind.

Boller, Franklin M., Accounting Statistics, Paul B. Warner and Company, New York, N. Y.

Bradford, Ralph J., Statistical Department, Western Electric Company, Hawthorne Station, Chicago, Ill.

Bruce, Harley N., Assistant Secretary, Security Life of America, Chicago, Ill.

Cady, Anson W., Statistical Clerk, Southwestern Bell Telephone Company, St. Louis, Mo.

Caprin, V. I., Bell Telephone Laboratories, Inc., 463 West Street, New York, N. Y.
Collett, John Parrett, Investment Banking, Fletcher American Company, Indianapolis, Ind.
Crandell, W. T., Carnegie Institute of Technology, Pittsburgh, Pa.
Craven, Charles R., Statistical Bureau, Denver University, School of Commerce, Denver, Colo.
Cravath, William B., 120 Broadway, New York, N. Y.
Crossen, Ernest P., Assistant Professor of Farm Economics, South Dakota State College, Brookings, S. Dak.
Davis, Hiram S., Fellowship, Bureau of Statistical Research, Denver, Colo.
Davison, Esther, Collection and Analysis of Data, Policy Holders Service Bureau, Metropolitan Life Insurance Company, 1 Madison Avenue, New York, N. Y.
Doherty, Richard P., Professor of Economics, Brown University, Providence, R. I.
Dowman, John P. G., Statistical Division, American Telephone and Telegraph Company, 195 Broadway, New York, N. Y.
Drachbar, William R., Analyst, Brooklyn Union Gas Company, 176 Remsen Street, Brooklyn, N. Y.
Eliot, William G., 3rd, U. S. Bureau of Public Roads, Washington, D. C.
Gammill, Miles Burd, Actuarial Department, Southern Union Life Insurance Company, Fort Worth, Texas.
Givens, Meredith B., Industrial Research, 3030 Euclid Avenue, Cleveland, Ohio.
Gowin, Dr. Enoch Burton, American Securities Service, Inc., 15 William Street, New York, N. Y.
Graff, Fritz William, Cleveland College, Euclid at East 20 Street, Cleveland, Ohio.
Graves, L. Wallis, Economic Research, Standard Oil Company of California, San Francisco, Cal.
Hastings, Hudson B., Professor of Industrial Engineering, Sheffield Scientific School, Yale University, New Haven, Conn.
Hayes, Dr. Mary H. S., 122 East 25 Street, New York, N. Y.
Heer, Clarence, Government Research, 347 Linden Place, Brooklyn, N. Y.
Herman, Clement A., American Locomotive Company, 30 Church Street, New York, N. Y.
Hinds, Kenneth W., Student, Columbia University School of Business, New York, N. Y.
Jessup, Mary Frost, 411 West 114 Street, New York, N. Y.
Johnson, Richard N., Sales Research, Pacific Mills, 24 Federal Street, Boston, Mass.
Jones, S. Lloyd, Vice-President, E. H. Scull Company, Public Accountants, 225 West 24 Street, New York, N. Y.
Kittredge, Mrs. Dorothea D., Assistant Professor of Agricultural Economics, University of Minnesota, University Farm, St. Paul, Minn.
Murray, Leslie H., Murray, Hannon and Murray, 135 West 47 Street, New York, N. Y.
Oley, Robert C., Estimating Crop Acreage and Forecasting Production, New Jersey Department of Agriculture, Trenton, N. J.
Petrellis, Alexander J., Standard Accident Insurance Company, Detroit, Mich.
Rankin, Erwin, Investment Trust Officer, Manufacturers and Traders Company, Buffalo, N. Y.
Robinson, Leland Rex, Trustee and Vice-President, International Securities Trust of America, 50 Pine Street, New York, N. Y.
Roe, E. Merle, Actuary, The Detroit Life Insurance Company, Detroit, Mich.

Rutledge, Dr. Richard Edward, City Schools, Room 1106, City Hall, Oakland, Cal.
Shepard, John Berdan, U. S. Division of Crop and Livestock Estimates, Department of Agriculture, Washington, D. C.
Silverman, A. G., Massachusetts Institute of Technology, Cambridge, Mass.
Stewart, Stella, Chief, Statistical Division, U. S. Tariff Commission, Washington, D. C.
Stover, Howard J., Department of Farm Management, Cornell University, Ithaca, N. Y.
Suffern, Dr. Arthur Elliott, Institute of Economics, 26 Jackson Place, Washington, D. C.
Toft, Margaret E., Actuary, Detroit Life Insurance Company, Detroit, Mich.
Van Drooge, Hubertus, Statistician, Consolidation Coal Company, 67 Wall Street, New York, N. Y.
Waugh, Frederick V., Director, Massachusetts Division of Markets, 136 State House, Boston, Mass.
Weeks, Ralph E., Supervisor of Statistics, Wisconsin Telephone Company, Milwaukee, Wis.
Wittig, Gustav F., Statistical Editor, *Electrical World*, Tenth Avenue at 36 Street, New York, N. Y.
Wormser, Felix Edgar, General Manager of Canadian Mines Merger, Ltd., Kaslo, B. C., Canada.
Woofter, Dr. T. J., Jr., Research Secretary, Institute of Social and Religious Research, 370 Seventh Avenue, New York, N. Y.

PROCEEDINGS OF THE EIGHTY-EIGHTH ANNUAL MEETING OF THE AMERICAN STATISTICAL ASSOCIATION

ST. LOUIS, MISSOURI, DECEMBER 28–30, 1926

PROGRAM

TUESDAY, DECEMBER 28

10.00 A. M. Hotel Statler, Daniel Boone Room

1. "The Distribution of Wealth"
   Willford I. King, National Bureau of Economic Research
2. "The Money Value of Human Life"
   Louis I. Dublin and Alfred J. Lotka, Metropolitan Life Insurance Company
3. "Mathematical Relationships of Supply and Price"
   F. A. Pearson and G. F. Warren, Cornell University

2.30 P. M. Hotel Statler, Assembly Room, Sec. 1

1. "A New Index for Industrial Production"
   Woodlief Thomas, Federal Reserve Board
2. "Forecasting the Volume and Value of the Cotton Crop"
   Bradford B. Smith, The White Motor Company
3. "Building Contracts and Business Movements"
   Thomas S. Holden, F. W. Dodge Corporation
4. "An Index Number of Consumption of Water Power and Fuels"
   Fred G. Tryon, Bureau of Mines, Washington, D. C.

WEDNESDAY, DECEMBER 29

9.00 A. M. Hotel Statler, Assembly Room, Sec. 1

Business Meeting

Election of Officers and Official Reports

10.00 A. M. Hotel Statler, Assembly Room, Sec. 1

1. "Electrical Energy Consumption as an Industrial Barometer"
   Robert M. Davis, McGraw-Hill Publishing Company, Inc.
2. "Population Forecasts as Regulators of Capital Expenditures"
   George J. Eberle, Eberle and Riggleman, Inc., and Univ. of Southern California
3. "District or Sectional Indices of Business"
   John R. Riggleman, University of California, at Los Angeles
4. "The Problem of Measuring Local Business Conditions"
   William A. Berridge, Brown University

2.30 P. M. Scruggs-Vandervoort, Barney Auditorium, 9th and Locust Streets

1. "A Stock-Price Index for Western Securities"
   John H. Cover, University of Denver
2. "Factors Affecting Changes in Short Time Money Rates"
   W. Randolph Burgess, New York Federal Reserve Bank
3. "Stock Price Movements as Forecasters of Business Changes"
   Charles O. Hardy, Institute of Economics
4. "Forecasting Business Profits"
   David Friday, Washington, D. C.

8.00 P. M. Hotel Statler, Ball Room

Presidential Addresses

E. W. Kemmerer, American Economic Association
J. L. Gillin, American Sociological Society
L. P. Ayres, American Statistical Association
"The Dilemma of the New Statistics"

THURSDAY, DECEMBER 30

9.00 A. M. Hotel Statler, Assembly Room, Sec. 1

Business Meeting

Reports of Committees and Other Business

10.00 A. M. Hotel Statler, Assembly Room, Sec. 1

1. "Appraising the Price Structure of Industrial Stocks"
   Edgar L. Smith, Investment Managers Company
2. "Relationships of the Money Market to Security Prices"
   Harold L. Reed, Chamber of Commerce of the United States
3. "The Relation of Profits to Security Values"
   Laurence H. Sloan, Standard Statistics Company, Inc.
4. "A New Index Number of the Prices of Industrial Stocks"
   Irving Fisher, Yale University

2.30 P. M. Hotel Statler, Assembly Room, Sec. 1

1. "Forecasting Security Price Movements by Quadrature Methods"
   Karl G. Karsten, New Haven, Conn.
2. "Business Conditions in Relation to Security Price Movements"
   Ray Vance, Brookmire Economic Service
3. "Controlling Factors in Security Price Movements"
   Leonard P. Ayres, The Cleveland Trust Company
4. "Turning Points in Major Swings of Security Price Movements"
   James F. Hughes, The Cleveland Trust Company

MINUTES OF THE ANNUAL BUSINESS MEETING

The first session of the annual business meeting of the American Statistical Association was held in the Assembly Room of the Hotel Statler, St. Louis, Missouri, on Wednesday, December 29, at 9 A.M. The meeting was called to order by President Leonard P. Ayres.

Miss Mary Van Kleeck read the report of the Committee on Governmental Labor Statistics and also the report of the Committee on the Encyclopedia of the Social Sciences.

The report of the Committee on Social Statistics was made by Professor Hornell Hart.

The report of the Committee on Institutional Statistics was read by Dr. Horatio M. Pollock.

Both the report of the Secretary and the report of the Treasurer were presented by Dr. Willford I. King. He also read the report of the Auditing Committee.

All of the above reports were ordered entered in the minutes.

On behalf of the Nominating Committee, Dr. W. W. Stewart offered the following nominations: President, Edmund E. Day; Vice-Presidents, Seymour

L. Andrew, Joseph S. Davis, Emanuel A. Goldenweiser; Counsellors, George P. Watkins, Henry L. Moore, Frederick R. Macaulay; Secretary-Treasurer, W. I. King; Editor, Frank A. Ross.

It was moved and carried that nominations be closed. A motion was carried instructing the Secretary to cast a unanimous ballot of the Association for the persons named by the Nominating Committee.

Dr. Edmund E. Day read the report of the Sub-Committee of the Association on the Social Science Research Council.

The meeting then adjourned.

The second session of the annual business meeting was held in the Assembly Room of the Hotel Statler, St. Louis, Missouri, and was called to order by President Leonard P. Ayres at 9 A.M. on Thursday, December 30.

In the absence of the representatives of the following committees, their reports were read by the Secretary of the Association: Advisory Committee on the Census, W. S. Rossiter; Sub-Committee on Mathematical Symbols, Victor Von Szeliski; Membership Committee, Edwin W. Kopf.

The report of the Committee on Standards for Graphics was presented by Karl Karsten.

It was unanimously voted that the following amendment to Article 3 of the Constitution be submitted at the annual Meeting of 1927 for final adoption:

> The membership of the Association shall consist of regular members, contributing members, corporate members, fellows, and honorary members.

It was unanimously voted to amend Section 2 of the By-Laws to read:

> The dues of members of the Association shall be as follows: regular members or fellows—$5.00 each year or $75.00 each for life membership; contributing members—not less than $25.00 each per annum; corporate members—$100.00 each per annum. All membership dues shall be payable at the beginning of the period covered.

It was also unanimously voted to amend Section 3 of the By-Laws to read:

> The Board of Directors, as soon as practicable after their election, shall appoint a standing Committee on Finance consisting of three members; and shall appoint from time to time such other committees as in their judgment are deemed necessary for carrying on the activities of the Association. These committees shall serve for one year, or until their successors are appointed.

Dr. Edmund E. Day, Chairman of the Committee on Fellows, reported the unanimous election by that Committee of Dr. Frederick C. Mills and Dr. Alfred J. Lotka as fellows in the American Statistical Association.

The motion to adjourn was carried.

WILLFORD I. KING, *Secretary*

Report of the Secretary

The gain in membership, while not as large as last year, has nevertheless been very satisfactory.

Membership, December 1, 1925		1,343
Additions during 1926	309	
Deductions during 1926:		
Deaths reported during 1926	14	
Resignations during 1926	53	
Dropped because unable to locate	15	
Dropped for non-payment of dues	50	
	— 132	
Net gain in membership during 1926	—	177
Membership, December 1, 1926		1,520
Besides members we have:		
Subscribers, mostly libraries	406	
Domestic Exchanges	20	
Foreign Exchanges	92	
	—	518
Total members, subscribers, and exchanges		2,038

The following deaths have been reported during the year: Judge Albert D. Bosson, Henry Farquhar, Professor Carlo Francesco Ferraris, Keppele Hall, John Moody, Jr., Albert G. Nash, Percy C. Papps, Charles F. Pidgin, Dr. Friedrich M. Schmidt-Ernsthausen, Professor Emile Waxweiler, Professor George C. Whipple, David L. Wing, Reverend W. C. Winslow, and George Wood.

Four numbers of the JOURNAL, containing 517 pages in all, have been issued during 1926. A New Handbook of 65 pages has also been published. These compose Volume XXI. A total of 25 pages of paid advertising appeared in the four issues.

The following district organizations have been established in addition to those already in existence: Denver and vicinity, Secretary, John H. Cover; San Francisco and vicinity, Secretary, A. H. Mowbray; Boston and vicinity, Secretary, Roswell F. Phelps; Columbus, Ohio, and vicinity, Secretary, Harry S. Will.

Each of the local organizations except Chicago has held at least one meeting during the year. The number of meetings held and the average attendance is tabulated below:

Chapter	*Number of Meetings*	*Average Attendance*
Boston	1	54
Cleveland	7	18
Columbus	7	24
Denver	12	30
Detroit	3	48
Los Angeles	8	18
New York	5	104
San Francisco	2	
Washington	3	73

The Employment Clearing House has been quite active in putting members in touch with statistical openings. It is at the service of all members who desire to make use of it.

Miss Abby Furbeck resigned her position as Assistant to the Secretary in March, 1926, and has been succeeded by Miss Helen W. Linke.

WILLFORD I. KING, *Secretary*

Report of the Treasurer Covering the Period December 1, 1925, to December 1, 1926

Receipts

Total cash not in savings banks December 1, 1925 ...		$1,013.84	
Bowery Savings Bank balance, December 1, 1925....		3,356.03	
Total.....			$4,369.87
Individual membership dues.....		$7,202.60	
Corporate membership dues.....		700.00	
Life membership dues.....		50.00	
Subscriptions to JOURNAL.....		1,993.47	
JOURNAL sales.....		868.87	
Memorial Volume:			
Sales direct to members.....	$70.50		
Royalties from Macmillan Company.....	87.85		
		158.35	
Advertising.....		628.00	
Interest.....		33.06	
Dividends.....		148.75	
Annual meeting dinner.....		475.35	
Gain from New York meetings.....		76.26	
Total receipts.....			12,334.71
Total.....			$16,704.58

Expenditures

Cost of JOURNAL:	
December, 1925, edition.....	$1,100.91
March, 1926, edition.....	981.38
June, 1926, edition.....	1,183.68
September, 1926, edition.....	1,118.12
Postage, stationery and miscellaneous printing.....	1,011.45
Salaries.....	4,510.33
Rent.....	264.00
Telephone and telegraph charges.....	90.48
Furniture.....	74.97
Annual meetings.....	483.24

Purchases of JOURNALS	$46.50	
Miscellaneous expenses, Editor's office	66.19	
Miscellaneous expenses, Secretary's office	72.91	
Total expenditures		$11,004.16
Total cash on hand November 30, 1926	$161.33	
Cash in Bowery Savings Bank, November 30, 1926	3,439.09	
Cash in Emigrant Industrial Bank, November 30, 1926	2,100.00	
		5,700.42
Total		$16,704.58
Total cash expenditures excluding New York meetings		$11,004.16
Direct expenses of New York meetings		1,276.01
Non-cash expenditures and credits		85.77
Direct expenses including New York meetings		$12,365.94

Functional Apportionment of Expenditures
(Including Overhead)

Annual and New York programs	$2,665.63	
JOURNAL	6,910.20	
Employment Clearing House	711.59	
New members	790.55	
Miscellaneous	1,287.97	
Total		$12,365.94

On December 1, 1926, the Association possessed in addition to stationery and miscellaneous supplies, the following assets:

17 Shares of Boston and Albany Stock, market value December 1.		$2,958.00
Furniture, carried at		331.14
Accounts receivable		293.20
Interest credited—not included in above receipts:		
Bowery Savings Bank	$103.68	
Emigrant Industrial Bank	56.66	
		160.34

JOURNALS, 6,127 copies.
Memorial Volumes, 168 copies.
There were no bills outstanding.
Up to date, returns from the Memorial Volume have shown a profit of $43.09.

AUDITORS' REPORT, AMERICAN STATISTICAL ASSOCIATION

We have examined the books and records in the office of the Treasurer of the American Statistical Association and have verified the bank balances.

We hereby certify that the Treasurer's report as submitted is in accordance with the books and records, and in our opinion correctly represents the financial condition of the American Statistical Association as of November 30, 1926, and receipts and expenditures during the year December 1, 1925, to November 30, 1926.

In our opinion, it would be preferable to transfer the item "Interest credited—not included in above receipts" from the miscellaneous assets at the close of the report to the summary of receipts and expenditures. This would increase the item "Receipts—Interest" from $33.06 to $193.40, and the total cash on hand and in banks from $5,700.42 to $5,860.76.

ROBERT W. BURGESS
R. C. EFFINGER
Auditing Committee

New York, N. Y.
December 22, 1926

Report of the Editor

During the past year the Editor has made every effort to increase the variety of the articles printed in the JOURNAL OF THE AMERICAN STATISTICAL ASSOCIATION, to preserve the quality of the several issues and yet to keep within the budget allocated to printing the JOURNAL. Owing to considerable reduction in the more costly types of articles—those containing many intricate mathematical formulas and those with elaborate tables—it has been possible to keep within the sum assigned for publication. This has also been achieved in part by reduction in the number of pages printed. The total of pages this year was 517, as compared with 598 in 1925, 562 in 1924, and an average of 550 over the six years 1920–25.

Because of the need for careful consideration of costs, no new developments have been attempted. It is hoped, however, that plans can be worked out during 1927 for certain changes which will increase the service of the JOURNAL to its readers at but slightly added cost.

The following table, furnished by the Secretary's office, shows the cost of printing the various issues of the JOURNAL for the past seven years:

	1920	1921	1922	1923	1924	1925	1926
Reprints	*	*	$237*	$213*	$262*	*	*
March	$776	$1,013	1,015	874	849	$1,169	$981
June	581	992	916	940	918	1,118	1,184
September	960	898	831	909	1,175	1,439	1,118
December	1,064	793	1,004	1,222	1,032	1,101	1,273
	$3,381	$3,696	$4,003	$4,158	$4,236	$4,827	$4,556

* Reprints recorded separately in three years only. In the other four years they are included with JOURNAL cost.

The Reviews section, under Dr. Leo Wolman, has been increasingly successful, both as to quality of reviews and the variety of volumes treated. The Editor is deeply appreciative of the efforts of Dr. Wolman and of the reviewers.

During 1926 there has been an unusually large number of replies to papers printed in the JOURNAL. A certain amount of scientific discussion is decidedly worth while. But it is not the intention of the Editor to devote an excessive amount of space to this, and it may be necessary to curtail the volume of these responses and to decline some papers that tend to stimulate too prolonged debate.

FRANK A. ROSS, *Editor*

Report of the Committee on Governmental Labor Statistics

The publication of *Employment Statistics for the United States*, a handbook of 215 pages, has been the principal activity of the Committee during the year. The report embodies the recommendations of the Committee for a national and state plan for current collection of statistics of employment. It contains detailed suggestions regarding methods of collecting, classifying, tabulating and reporting the data. The chief burden of preparing this book fell upon the Secretary of the Committee, Dr. Ralph G. Hurlin, aided by the co-editor, Dr. William A. Berridge. The Russell Sage Foundation bore the expense incident to preparing the manuscript, and is the publisher.

Efforts are being made to bring the report and its recommendations to the attention of governmental bureaus, business establishments, trade unions, social and charitable organizations, which must bear the burden of relief of unemployment, and civic and business organizations, including chambers of commerce. The report was announced last summer by an advance notice which was published in newspapers in many different parts of the country. In June the Chairman described the Committee's plan in an address before the Association of Governmental Labor Officials at its annual convention. Trade papers and some newspapers which give special attention to statistics of business are printing material provided for them by the Committee, and a few of the more important trade journals are assigning staff members to prepare special articles. We anticipate additional comment and discussion through book reviews, which we hope will be critical and constructive. Notices of the book have been sent to nearly 10,000 persons. The Committee hopes that, beside having practical results in stimulating the more adequate collection of these statistics, the report may be useful in teaching statistics.

During the year, New Jersey has joined the states collecting employment statistics in coöperation with the Federal Bureau of Labor Statistics. The Federal Reserve Bank of Philadelphia had been collecting the data in that state since January, 1923. As soon as the state bureau was ready to undertake it, the bank asked New Jersey establishments to transfer to the state bureau their future reporting, turned over to the bureau photostat copies of its past reports from New Jersey firms which gave their consent, and in other ways made available all its past experience. In turn, the state bureau is furnishing advance reports to the bank. New Jersey firms which have hitherto made reports to the Federal Bureau of Labor Statistics, several of which reported also to the Federal Reserve Bank of Philadelphia, now report only to the state bureau, which trans-

mits the necessary data to the federal bureau. The whole experience illustrates the coöperative spirit of the Federal Reserve Banks and the smooth working of the relationships between reporting firms, the state department of labor and the Federal Bureau of Labor Statistics under the plan recommended by the Committee.

Following the conference of the Committee early in the year, at which the chief subject of consideration was the possibility of collecting current data on labor turnover, the Industrial Commission of Wisconsin added a question to its schedule for employment statistics, calling for the number of separations from the payroll. As yet, no report on the results of this experience is available, but it will be watched as a guide for other bureaus.

In 1927 the Committee will include in its program a continuing interest in employment statistics, seeking to enlist the coöperation of state departments of labor which do not now collect them, and especially studying the possibility of perfecting the data and improving the industrial classification in order to make the material more fully comparable in different states. The Committee will also include in its program, as soon as practicable, the problem of collection of significant statistics of wages and earnings.

The membership of the Committee during the past year has been as follows: A. J. Altmeyer, Secretary of the Industrial Commission of Wisconsin; Charles E. Baldwin, Chief Statistician, United States Bureau of Labor Statistics; Joseph A. Becker, Statistician, Bureau of Agricultural Economics, United States Department of Agriculture; William A. Berridge, Associate Professor of Economics, Brown University, and Economist, Metropolitan Life Insurance Company; Louis Bloch, Statistician, California Bureau of Labor Statistics; W. Randolph Burgess, Assistant Federal Reserve Agent, Federal Reserve Bank of New York; R. D. Cahn, Chief of Bureau of Industrial Accident and Labor Research, Illinois Department of Labor; R. H. Coats, Dominion Statistician, Canada; Frederick E. Croxton, Lecturer in Statistics, Columbia University; J. Frederic Dewhurst, Chief, Statistical Division, Federal Reserve Bank of Philadelphia; Leonard W. Hatch, Director, Bureau of Statistics and Information, New York State Department of Labor; Richard H. Lansburgh, Secretary of Labor and Industry, Pennsylvania; Don D. Lescohier, Professor of Economics, University of Wisconsin; Eugene B. Patton, Chief Statistician, New York Department of Labor; Roswell F. Phelps, Director, Division of Statistics, Massachusetts Department of Labor and Industries; Woodlief Thomas, Division of Research and Statistics, Federal Reserve Board; F. G. Tryon, Statistician, United States Bureau of Mines, Department of Commerce; W. W. Ward, Deputy Minister of Labour, Canada; Ralph G. Hurlin, Director, Department of Statistics, Russell Sage Foundation, Secretary.

Respectfully submitted,

MARY VAN KLEECK, *Chairman*

Report of the Membership Committee

During the past year the Membership Committee has been attempting to interest members in Philadelphia and in Ottawa, Ontario, in the formation of local sections or district chapters of the Association. Philadelphia ought to have

and to support a vigorous local section of the Association. This city was the birthplace of American official statistics, and certainly of mathematical statistics. As soon as some of our members in the city can be induced to assume charge of membership and other local activities, a section can be formed. It is thought that such an organization will be of distinct service to the many industrial, financial and philanthropic organizations, which, with the two important universities, use or cultivate statistics in its several branches.

Regional organization in Canada seems to be indicated, also. Ottawa, especially, has several hundred persons who are more or less intimately connected with the system of official statistics for the Dominion. Furthermore, Canada is attracting from the mother country more and more of the actuaries and accountants whose training in statistics is rigorous and thorough, and whose membership in the Association should be solicited. We should remember that our Association covers the Americas and that its activities were never intended to be confined to the United States.

Outside these major activities, various members of the Committee have on occasion done the usual missionary work to secure new members, but wish to report that these efforts have not yielded the results which follow local sectional organization and the offering of objective evidence to candidates of the benefit of membership in the Association.

EDWIN W. KOPF, *Chairman*
A. H. MOWBRAY
W. RANDOLPH BURGESS
JESSAMINE S. WHITNEY

Report of the Committee on Institutional Statistics

Your Committee is happy to report that the year just passed has been one of great significance in the field of institutional statistics and that one of the principal objectives of the Committee has been attained.

At a conference held in Washington, April 28, 1926, the Director of the Federal Census Bureau agreed to compile institutional statistics hereafter *annually* instead of *decennially*, the first annual census to cover the year 1926.

This conference, which marks the beginning of a new epoch in the history of institutional statistics, was called as a result of requests made late in 1925 to Secretary Hoover by the President of this Association and by representatives of several other national organizations interested in institutional statistics. Your Committee was represented in the conference by its Chairman and by Dr. Joseph A. Hill, who also was one of the representatives of the Census Bureau. Other organizations represented included the American Psychiatric Association, the American Prison Association, the American Institute of Criminal Law and Criminology, the Russell Sage Foundation, the National Committee for Mental Hygiene, the State Department of Welfare of Pennsylvania, and the State Hospital Commission of New York.

After general discussion of the need for up-to-date statistics concerning the institution population of the country, the members of the conference unanimously

agreed that it is now practicable for the Federal Census Bureau to undertake the annual collection of statistics in institutions for the mentally diseased, the feeble-minded, the epileptic and the delinquent. A series of resolutions were passed stressing the importance of securing current data and setting forth the general scope of the statistics to be collected from the several classes of institutions. It was arranged that the conference should appoint two advisory committees to assist the Census Bureau in formulating plans for taking the annual census, one committee to deal with the census of institutions for the mentally diseased, feeble-minded and epileptics; the other, with the census of institutions for delinquents.

In accordance with the action taken by the conference, the Census Bureau with the assistance of the committees appointed has prepared schedules and manuals of instructions and has sent out preliminary letters to advisory boards and institution heads. It is planned to send the blank schedules to institutions early in January, 1927.

The significance of this action by the Federal Census Bureau will be apparent when we recall that hitherto practically the only nation-wide data available concerning our institution population have been census reports compiled at intervals of six to fourteen years.

For making this important change in the frequency of collection of institutional statistics the Director of the Census Bureau is entitled to great credit. Without his interest and coöperation no progress could have been made.

Two reports of the institution census of 1923 were issued during the year. The one relates to children in institutions and the other to patients in hospitals for mental disease. The report dealing with feeble-minded and epileptics in institutions, and the one concerning prisoners are in type and will probably be issued early in 1927. The delay in the publication of these reports is most unfortunate, but there seems to be no way to expedite the work in the public printing office.

The Federal Children's Bureau completed early this year a comprehensive manual or guide for the preparation of statistics in juvenile courts. If the excellent plan outlined is adopted generally by such courts we shall soon be able to obtain long-sought-for data concerning the operation of these courts in various parts of the country.

The Committee on Statistics of the American Institute of Criminal Law and Criminology has outlined a system of records and statistics for the use of criminal courts. The need of uniformity in this field has long been felt, but thus far all efforts to secure necessary coöperation on the part of the courts have proved unavailing. It would seem that the courts cannot much longer ignore the public demand for more adequate reports of their work.

Your Committee is continuing to coöperate with various national organizations interested in institutional records and statistics, and is endeavoring to secure the general adoption of a uniform record system in each class of institutions, thus laying the basis for the later collection of reliable comparative data from institu-

tions in every part of the country. The progress made has been gratifying, but much still remains to be done.

Respectfully submitted,

HORATIO M. POLLOCK, *Chairman*
KATE H. CLAGHORN
EDITH M. FURBUSH
JOSEPH A. HILL

Report to the American Statistical and American Economic Associations of the Joint Advisory Committee to the Director of the Census

The year 1926 is the eighth of practical coöperation between the Census Bureau, the most important statistical organization in the Federal Government, and the two Associations invited in 1918 by the Secretary of Commerce to form an advisory group.

During the past three or four years, which may be regarded as the height of what is known as the intercensal period, during which the coöperation of the two Associations is less urgently needed than in the census period proper, conferences of the Joint Committee with the Bureau have been held but two or three times a year. During the past year there have been but two meetings. The first occurred on April 16 and 17, and the second on December 18 and 19.

At the first meeting five of the six members were present and the Director submitted to the Joint Committee various problems connected with the proposed Census of Transportation by Water as authorized by the Census Act, the policy in connection with which was complicated by the statistics already being collected by other branches of the Government in connection with this subject. Plans in connection with the Census of Religious Bodies were discussed and also the proposed annual Census of Institutional Classes. A report was made upon the progress of the monographs originally recommended by the Committee and still incomplete. The Director outlined to the Committee the progress being made in closing up the Agricultural Census of 1925, and discussion occurred also upon the Census of Prisoners, upon the report upon the Blind and Deaf, and considerable attention was paid to the problem of estimates of population which the Bureau has heretofore been accustomed to issue and concerning which there are many related problems. The work of the Division of Vital Statistics was reviewed and also the work of the Bureau upon a proposed Census of Distribution and in connection with Financial Statistics of Cities and the determination of immigration quotas. As the result of the sessions, occupying two days, eight formal recommendations were made to the Director by the Committee for his guidance in connection with the subjects fully discussed. These recommendations are appended.

The second meeting, held during the present month, was attended by the full membership of the Committee and dealt with the subjects of extension of the registration area, estimates of population, the inadequacy of appropriations for the completion of the recent Census of Agriculture, the practicability of a Census of Distribution, proposed changes in the format of the biennial Census of Manufactures, preparations for the Census of 1930 and certain related problems. The

current work of the Bureau was also reviewed and problems discussed as relating to the Religious Census, Financial Statistics of Cities, Transportation by Water, and certain other current statistical activities, and the Director outlined general conditions in the Bureau. Thus the December meeting was a particularly full one, and two entire days were occupied with a review and discussion of the activities and projects of the Bureau, leading up to a number of formal recommendations, which are also appended.

With the approach of the decennial census, preparation for which must be taken up in earnest in another year, it was agreed that the various recommendations of the Joint Committee, now reaching a total of approximately 175, should be classified by subjects, and the Committee will furnish printed leaflets of these recommendations so that they may be regarded as a body of general comments bearing upon the practical requirements of the Bureau during the census and the intercensal periods.

The Joint Committee invites the attention of the two Associations to the fact that this practical coöperation grew out of the precedents established so freely during the war for coöperation with the Government by other interests, and the Bureau considers the contact of the greatest value. Procedure and precedents are now so fully established in the movement of these conferences that the meetings of the Joint Committee with the Director of the Census resemble to a gratifying degree the stated meetings of the board of directors of a large industrial enterprise in which the directors take far more than a perfunctory interest and each participates in a helpful way in meeting large problems and shaping policies. Your Joint Committee is strongly of the opinion that few contacts established during or just after the war period have survived with such continuing usefulness or have made themselves so invaluable to a large Government organization as the assistance which is being given by the American Economic and the American Statistical Associations to this great statistical organization of the Government in meeting its increasing problems, due not only to the demand upon its resources for new inquiries and greater usefulness to the public, but also to that other class of problems arising out of the immense increase in the population of the nation which has occurred during the present century.

Your Committee would fail in its duty in reporting progress to the Associations if it did not express its admiration for the manner in which Director William M. Steuart of the Census is performing his arduous task. We have pleasure in reminding the Associations that it was largely due to the earnest recommendation of the Joint Committee, from an entirely unbiased standpoint, that Secretary Hoover requested the appointment by the President of Mr. Steuart to this important position.

With much respect,

For the American Statistical Association
W. S. Rossiter, *Chairman*
Robert E. Chaddock
Seymour L. Andrew
For the American Economic Association
Walter F. Willcox
Allyn A. Young
George F. Warren

RESOLUTIONS ADOPTED APRIL 16 AND 17, 1926

155. In view of the fact that the taking of a census of water transportation entirely on the basis of a schedule to be filled out by the operators of the vessels, as was done in 1916, would involve a large amount of duplication of the work already done by other Federal offices, the Committee favors a plan which involves

1. Obtaining information with regard to tonnage, equipment, horsepower, etc., of documented American vessels from the records of the Bureau of Navigation, so far as practicable.

2. Obtaining statistics with regard to tonnage of freight and number of passengers carried from the Board of Engineers for Rivers and Harbors of the War Department.

3. Obtaining by direct inquiry such other important items as are not available from government sources, including gross income, payments for salaries and wages, number of persons employed on land, etc.

156. The Census of Religious Bodies in the United States, which is about to be taken by the Bureau of the Census for the year 1926, is the fourth special census of this character. It is taken according to law and responds to the widespread demand for information covering church membership. With this end in view the Committee recommends that the enumeration of church membership shall be made on as uniform a basis as practicable for all denominations and that data regarding church expenditures, church schools, and other subjects shall be standardized as far as possible.

Of the general plans of procedure outlined by the Director and Chief Statistician it recommends omission from the report on this census of the major part of the material descriptive of the different denominations which was printed in Part II of the 1916 report on Religious Bodies, provided that sufficient explanation of the membership regulations of each denomination shall be given to enable a reader to make due allowance for the differences in this respect in comparing the figures of one denomination with those of another, and provided that reference be made to the previous census volume which contains full descriptions.

157. The Committee recommends that the monograph upon Wages in Manufacturing Industries should be published without fail during the present calendar year.

The Committee considers that so much time has elapsed since the monograph was begun that it is essential that this publication should be published during the present calendar year.

158. The Committee recommends that the reports on the Blind and the Deaf be published separately in the monograph series. It expresses the opinion that tabular matter so extensive as is found in the monograph on the Blind can be justified only by special excellence in the material or by special demand for information in such detail.

159. The Committee recommends that all estimates of population to be published before the results of the census of 1930 are available should be published

as round numbers in order to emphasize the fact that they are only approximations.

160. The Advisory Committee believes that it is unfortunate for the different branches of the Federal Government to utilize more than one estimate of the population of the United States and recommends that the Director of the Census endeavor to obtain a general agreement to use the estimates prepared by the Bureau of the Census as the official Federal estimate.

161. The Committee believes that the extension of the death registration area and the birth registration area at the earliest possible date to include all the states is of fundamental importance as a part of the population statistics of the country, and heartily approves the efforts that the Bureau of the Census is making to secure that result. They are convinced that those statistics are essential for informing the public about the health of the community and for guiding efforts to improve that health.

162. Chief Statistician for Vital Statistics is requested to report to the Committee the number and distribution of the published rates in the last annual volume of births and deaths classified by the number of births and deaths involved and by the population involved.

DECEMBER 17 AND 18, 1926

163. In view of the expense involved in securing additional information direct from the operators of the boats, and of the relatively unimportant nature of the additional items that might be obtained in that way, the Committee approves the limitation of the report on water transportation to that information which can be obtained through the Board of Engineers for Rivers and Harbors of the War Department, the Shipping Board, the Bureau of Navigation, and other governmental agencies now collecting statistics of water transportation.

164. That the Committee approves the policy of the Director of giving publicity to the results of any statistical inquiry as rapidly as those results are reached and established and recommends that this policy be followed in the census of religious bodies.

165. The Committee recommends that in connection with the statistics of divorces now obtained by the Bureau, statistics of annulments of marriages be also secured.

166. In the belief that state registration of marriages and divorces may be effectively controlled by the state offices that now have charge of the registration of births and deaths, the Committee recommends that the men who are now in the field in the interests of the extension of the registration areas for births and deaths be instructed to secure information as follows:

1. Whether any provision is made by state laws for such registration or for the collection of records of marriages and divorces by any state office.

2. The manner in which such state laws are being carried out.

3. The extent of local interest, if any, in the subject of improved state records of marriage and divorce.

4. Whether any legislation on this subject is pending or is likely to be recommended soon by local interests.

167. The Committee recommends that, on the basis of information thus secured from this way and other available sources, measures be taken, as soon as expedient, to extend state registration of marriages and divorces.

168. With reference to the extension of the registration area, the Committee is of opinion: (1) That the enactment of a satisfactory law does not of itself justify the admission of a state to the registration area, but that the degree of efficiency with which the law is enforced should also be taken into account. (2) That the Bureau should continue to advise with state and city officials with respect to the methods of improving the registration of births and deaths, but —(3) That as a general rule the Bureau should not take upon itself any actual field work looking toward the securing of more complete reports of births and deaths.

169. Recommended that estimates of the population for states be continued down to 1930, but that the publication of estimates of population for all counties and for all cities under 30,000 be discontinued beginning with the year 1926.

170. The Committee reminds the Bureau of its former recommendation that all publications of vital statistics be in octavo form and notes that the only current publications not now in that form are the reports on births and deaths. The Committee recommends that serious consideration be given to the adoption of the octavo form in these publications at the earliest practicable moment.

171. The Committee recommends that the information currently given out respecting deaths in different cities on account of automobile accidents should include (1) the number of such deaths for the last months, and (2) the death-rate for the last 12 months, together with such comparisons as may be thought desirable with the numbers of deaths in preceding months or with death-rates in preceding periods of 12 months each.

172. The Committee recommends that the statistics assembled for the record book of current statistics be published in parts or installments as completed, preferably in octavo form.

173. The Committee expresses regret that the Bureau of the Census after having completed the tabulation and publication of so much of the agricultural census is unable, because of lack of funds, to complete the task. The Committee urges that the remainder of the work be completed either by securing additional appropriation, if possible, through outside appeal or else that the Director of the Census complete the general tabulations so as to permit the publication of a part, at least, of data now lacking.

174. The Committee recommends to the Director of the Census that the reports on financial statistics of cities be extended from cities of 30,000 down to cities of 25,000 and over as shown at the Fourteenth or subsequent official census.

Report of Committee on the Encyclopedia of the Social Sciences

As one of the seven associations coöperating in plans for an encyclopedia of the social sciences the American Statistical Association, through its Committee on this subject, has received a report from the Chairman of the Executive Committee, Professor Edwin R. A. Seligman, which may be summarized as follows:

The chief task during the year has been the financial campaign, which could not be undertaken until the late spring, because not until the end of April, 1926, was the acceptance of the plan authorized by all the associations involved. The plan contemplates the raising of approximately $650,000. About five-sixths of this sum is now assured. The Chairman, who has carried the responsibility for raising the fund, needs now the coöperation of every member of the Association to canvass the possibilities in his own city or town, since the amount already assured is conditional upon the pledging of the total amount needed.

It is the expectation, however, that the fund may be completed during the next few months. The Association is asked, therefore, to constitute its representatives to act as a permanent Committee, charged with the responsible duty of overseeing the activities of the Executive Committee in working out the details of the plan and putting it into operation. This involves not only a series of important financial contracts, but, far more important, the final decision as to the methods, contents and details of the encyclopedia itself. A renewal of the grant made last year to defray secretarial expenses is also asked.

It will be recalled that the encyclopedia as now planned would constitute an authoritative summary of results achieved in the various branches of the social sciences. Just as the great French encyclopédie in the eighteenth century marked an epoch by turning men's thoughts to the world of nature, so it is believed that a great encyclopedia of the social sciences might mark a similar epoch in stimulating progress in all the various disciplines that constitute the science of society.

The Associations now coöperating in the project, and their representatives on the joint Executive Committee, are as follows:

American Economic Association, Edwin R. A. Seligman, *Chairman*
American Historical Association, Carleton J. H. Hayes
American Political Science Association, John A. Fairlie
American Sociological Society, A. A. Goldenweiser
American Anthropological Association, Clark Wissler
American Statistical Association, William F. Ogburn
American Association of Social Workers, Mary Van Kleeck

The Committee of the American Statistical Association appointed to coöperate in the project is composed of Mary Van Kleeck, *Chairman*, William F. Ogburn and R. H. Coats.

Report of the Committee on Social Statistics

The Committee on Social Statistics was appointed early in this year as a direct result of a meeting held at the time of the annual meeting of the Association last year by a group of members of the Association who were interested in the development of social indexes. At this meeting a resolution was adopted requesting the Association to appoint a Committee to investigate the desirability and feasibility of establishing indexes of dependency and of other variables reflecting social conditions. Although the name under which the Committee was appointed indicates a broader scope, it was especially charged with this problem.

Attention has been given to this problem during the year. The Committee finds that a large amount of material is already available for experimentation in the construction of social indexes, and that indexes of various aspects of social welfare accurately and currently compiled would be of great usefulness. It believes that experimentation in the construction of such indexes is distinctly desirable, but recognizes need for extreme caution in the interpretation of social indexes composed of varied elements. It further believes that one of the most pressing needs at the moment is for the development and standardization of the statistics of social work which are needed in the construction of social indexes. To this portion of the problem the Committee is directing special attention.

The Committee has held two meetings during the year. The first was held on May 30 at Cleveland in connection with the National Conference of Social Work. At that time the Committee adopted a resolution requesting consideration by the Association of the desirability of introducing regularly at the annual meetings of the Association a program or programs dealing with social statistics, and of the possibility of organizing sections within the Association, one of which might be a section on social statistics. The Committee finds increasing interest in the numerous fields of social work in the application of statistics to the administration and evaluation of their work, and believes that this interest might justify the establishment of such a section.

A second meeting of the Committee was held on December 10 at New York. At this time representatives from five different fields of social work were invited to meet with the Committee to discuss the status of statistics representing each of these fields as a whole and the prospects for standardization of these statistics and their collection on a monthly basis. The Committee has assembled an impressive list of statistical projects, now under way or immediately in prospect, in the different fields of social work which have as their object the production of current data representing the volume and character of work done.

The Committee respectfully recommends that it be continued with the following definition of its purpose: To act insofar as possible as a clearing house for information about studies concerned with the development and analysis of statistics of social welfare, and to promote and correlate the gathering of representative statistics in the various departments of social welfare activity.

Respectfully submitted,

Ralph G. Hurlin, *Chairman*
George R. Bedinger
William A. Berridge
F. Stuart Chapin
Neva R. Deardorff
Emil Frankel
Hornell Hart
Philip Klein
Linton B. Swift
Emma A. Winslow

Report of the Joint Committee on Standards for Graphics

The Committee is, as we understand it, a standing Committee, and intended to provide a medium for just so much progress and development as seem really to be desired, rather than to attempt to force any development prematurely. It is hoped that we can serve to guide and assist developments, rather than initiate too many questionable measures.

The Committee has, however, prepared through Mr. Richardson, one of its members, an elementary glossary of nearly ten pages dealing with the technical terms used in graphics. This report has been made to include the suggestions of the other members of the Committee, Professor Fisher and myself, but is otherwise the work of Mr. Richardson and is viewed favorably by us. It has been published by the American Telephone and Telegraph Company and it may be that it will be offered for publication in the JOURNAL.

The Committee has also prepared a dictionary of technical terms used in graphics, translating these into four foreign languages, with the thought that this might help to avoid much confusion in graphics in future years, which might arise if no translation of technical terms were available.

The Committee has not taken any action on Tabulation Standardization, but it is my hope that some recommendations will be eventually prepared, perhaps after an investigation through a questionnaire, among the members of the Association, which would lead to the determination of the more useful forms of standard tables for time and frequency distributions.

I also hope that a similar procedure can be followed in the matter of Historical Chart Scales whereby a few standard time scales for the horizontal axes can be developed through a similar questionnaire. As a preliminary step towards such standardization of time series curves, I have already been effective, with Professor Fisher, in guiding the publication of printed charts by one of the information publishing services, and Professor Fisher is planning an elaborate volume consisting wholly of charts, in which the ideals of standard scales are carefully observed.

The Joint Committee recently formed by the Engineering Society has elected me Chairman of a sub-committee on Time Series, in which I hope to coördinate the efforts along this line, perhaps the most important form of graphic standardization now possible.

If it is in place for me to recommend our relations to the Joint Committee, may I suggest that since our purpose is altogether for the advancement of the art, we should be empowered with discretionary powers to coöperate with the Joint Committee so far as that serves the best purpose in this field, without being compelled to follow the dictates of representatives from other fields which are perhaps less directly concerned with graphics than the statisticians.

KARL KARSTEN

Report of the Sub-Committee on Mathematical Symbols by the Appointee of the American Statistical Association

The purpose of this Sub-Committee is to standardize the commonly employed mathematical symbols and notations. This involves, for instance, indicating preferred symbols and notations when alternatives occur.

A meeting was held on May 1, 1926. Dr. E. V. Huntington was elected Chairman. Recommendations covering the fields of arithmetic, algebra, geometry, transcendental functions, calculus, and so forth, were acted upon. Special reports on Bessel functions, Bernoulli numbers, and vector analysis are now being prepared.

In the opinion of the Committee the time is not yet ripe to standardize the notation used in mathematical statistics.

VICTOR VON SZELISKI

Report of the Committee on Advertising

The Committee on Advertising held one meeting, and discussed possible sources from which advertisements might be obtained. In accordance with suggestions made, the Secretary of the Association secured two additional pages of advertising for the JOURNAL.

PAUL T. CHERINGTON, *Chairman*

REVIEWS

The Agricultural Problem in the United States, by National Industrial Conference Board, Inc. New York. 1926. 157 pp.

This stimulating volume, dealing with one of the most important subjects of the day, merits the respectful but critical consideration of students of economic development and national policy. It contains much of real value, is engagingly written, has been given excellent publicity, and has apparently exerted wide influence. Since many of its conclusions rest upon statistical data and analysis, it deserves the special scrutiny of economic statisticians familiar with American agriculture and its history.

The report is frankly presented as authoritative. It "is the result of an investigation conducted by Mr. Virgil Jordan and assistants, of the Conference Board's Research Staff, under the supervision of the Board's Staff Economic Council." Acknowledgment is made to "numerous farm leaders, business executives, economists and others especially familiar with agricultural conditions for their many helpful suggestions and criticisms," and to an Advisory Committee on Agriculture, including such well-known names as Alexander Legge, Frank O. Lowden, Elwood Mead, F. A. Pearson, S. H. Thompson, and Owen D. Young, for its close coöperation.[1] The conclusions are "those of the Conference Board as a body."

Moreover, the report is intended to lead to action. It concludes with a recommendation (pp. 149–150):

> . . . it would seem proper and desirable in the national interest for representatives of American industry, commerce, transportation and finance, in conjunction with leaders of agriculture, to study jointly and sympathetically, *on the basis of the Conference Board's report*,[2] the agricultural situation and its causes, to appraise its consequences and to present for the consideration of the public their mature judgment of the possibilities and desirable avenues of remedy and readjustment. In this way it is possible that, apart from the disturbing and transient influence of partisan politics, there may be provided a constructive and practical plan for mutual understanding and full coöperation between agriculture and all other groups in our productive life, as well as a basis upon which may be developed a sound and far-sighted national policy embracing and justly balancing all the interests involved. . . .

An outgrowth of this recommendation is the "Business Men's Commission on Agriculture," created jointly by the Conference Board and the Chamber of Commerce of the United States.

The viewpoint and purpose of the report are expressed in the foreword.

> The position of American agriculture is of vital concern to all the people of the United States, not only for today but for the future as well. . . . It involves the national security, the racial character, the economic welfare and the social progress of our people.

[1] One member of the Advisory Committee, President W. I. Drummond of the American Farm Congress, has since complained that neither manuscript nor proof sheets had been submitted to him before publication. *The Agricultural Review*, August 1926, p. 4.

[2] Italics are the reviewer's. The whole passage is italicised in the report.

> The development of sound, far-sighted national policies in respect to agriculture is, therefore, one of the most important problems before the country today. . . . We have as a people to determine deliberately and wisely the rôle which we wish to have agriculture play in our national economic life, in the light of full knowledge as to whether and in what respects its position is weak and why, and on the basis of sound judgment as to how it can best be strengthened.
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> In the development of such policies and the determination of such questions it is the duty of all groups to take part. . . .
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> For these reasons the National Industrial Conference Board, as an organization for the study of questions affecting the welfare of American industrial-economic life, has undertaken in this report to examine the main features of the agricultural problem in the United States. Its primary purpose is to clarify the problem as a whole, so as to contribute to a better and more general understanding of it not only by American industry, but by the general public, and so to provide a common basis for such sound policies as may assure the country a prosperous agriculture as a part of a prosperous national economy.

The introductory chapter discusses briefly the economic, political, and social significance of agricultural problems, rightly stresses the importance of considering agricultural policies in relation to our national economic development as a whole, and proceeds to discuss the permanent aspects of this "peculiar, complex, and widely changing industry." The second chapter deals with the economic position of American agriculture before, during, and since the war, with reference to our agricultural plant, international trade, agricultural products in consumption, costs and prices, and the share of agriculture in the national income. The third chapter considers the factors in agricultural income—production, demand, sales and markets, and prices. The fourth chapter deals with factors in agricultural costs. The final chapter presents a general summary and conclusions.

The broad viewpoint and general tone of the report deserve high commendation. It should do much to induce business men to give sympathetic consideration to the farmer's difficulties. On the other hand, the present reviewer, after careful study of the report, is convinced that it is inaccurate in its diagnosis of the agricultural situation and its interpretation of our economic history, and therefore affords an unsafe basis for consideration of remedial measures. In his judgment, some of its major propositions are untenable, many of its implications are misleading, and what it regards as symptoms of disease and maladjustment are in part evidences of healthy adjustment to changing conditions. Because of the importance of the subject, the wide publicity of the report, and the implied intention to use it as the basis for a serious conference, the reviewer feels called upon to set forth, in the most friendly spirit, some basis for his criticisms.

The report lays great stress on the interdependence of agriculture and industry. The broad facts none would dispute; but the report throws little light on the nature of the interdependence, and the frontispiece chart, designed to show a controlling influence of agricultural income on the volume of trade, is seriously misleading.[1] Four or five years ago farmers' advocates argued that industry

[1] See a note in the *Journal of Farm Economics*, October, 1926, for the reviewer's criticism of this chart as presented by its original author. In a word, the index of farmer's real income as computed is both unreliable and not comparable with Snyder's index of volume of trade. Curiously enough, the easiest (though erroneous) inference from the chart is that farmer's real income has been above normal since the middle of 1922—an inference quite at variance with the facts as well as with the Board's report.

could not hope to prosper except as agriculture recovered. Agriculture indeed improved, but industrial prosperity preceded and greatly exceeded agricultural recovery. Latterly, similar spokesmen have urged that our industrial prosperity will rest on weak foundations until radical improvements in agricultural income are achieved. As a matter of fact, we still know far too little, in definite terms, concerning the relations between agriculture and the business cycle, as well as between trends in agriculture and industry, to justify such statements. The subject merits intensive investigation which it has not yet received.

The importance of agriculture to national welfare is unquestionably great, but the report rather overstates the case. Agriculture is not "the basis of our industrial prosperity" (p. 142). That basis, truly viewed, consists in part of our natural resources of many kinds and our accumulation of physical capital in many forms, but more in the quality of our human resources, our breadth of populated area under a single sovereignty, and our intangible capital of ideas, spirit, and economic habits. Cities not less than farms are sources of supply of future citizens, and conditions in both deserve consideration from this standpoint. It is far-fetched to say that "the strength of our agriculture may have a vital bearing on our national security in the future," except as the statement might apply to innumerable elements in our national life.

It is well said (pp. 142–143) that agriculture "presents an inseparable intermixture of a way of living, an investment, a business and a gainful occupation or employment"; but the contrast between agriculture and other occupations is overdrawn. The phrase, "the inherent instability of agricultural production" (p. 142), implies too much: ups and downs of crops and prices are important, but as a whole agriculture is relatively stable; indeed its very stability retards the process of readjustment. Diversity of interests is no more characteristic of farming than of industry, transportation, and trade.

The outstanding conclusion (pp. 143, 144, 148) is a gloomy interpretation of our agricultural history:

> . . . the available information indicates the strong probability that, for a considerable period before the war, and at least as early as the beginning of the present century, there have been in operation forces which have tended to create a progressive inequity and maladjustment between the position of agriculture and that of other branches of our economic life . . . while the position of agriculture since 1920 reflects chiefly the disturbance and upheaval of the war and post-war period, unfavorable factors in the agricultural situation have been in operation since the beginning of the century, and have been in some way related to the rapid expansion of industry, trade, finance, and government during the past twenty-five years. . . .
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> . . . fundamentally adverse conditions, making for a general and persistent inequity and maladjustment, not only constitute a serious menace to the progress and prosperity of American industry, commerce and trade, but are equally of great significance for our national welfare, for they affect the future economic development, the social advancement, the political unity and the national security of the United States.

The evidence marshalled in support of this conclusion is far from convincing, and examination of the several points discloses serious misinterpretations.

"The contraction of our agricultural 'plant' and its production relative to the growth of our population"—an unquestioned fact—is not ominous evidence

of maladjustment. It has been true through most of our national history. In our early days agriculture strongly predominated, commerce was an important second, industry a very poor third. Industry has increased most, commerce next, agriculture least. The causes of these trends are legion. In part they are due to the fact that in new countries agriculture, pastoral occupations, and mineral extraction are necessarily the first sources of wealth, beyond trade with primitive inhabitants; as population increases and as capital is invested, industry can develop. In part the trends are due to the inventive, managerial, and financial genius of Americans, and to the fact that industry, transportation, and trade are better adapted than agriculture to take advantage of advances in invention, organization, and finance. Many other causes could be cited. Whatever the explanation of this shifting position of agriculture in our national economy, it is certainly neither new or catastrophic. In any dynamic society equilibrium is maintained only by a process of continuing readjustment among the component parts. A balanced industry, a balanced agriculture, a balanced national economy in no way implies a stationary condition, or conformity to some ideal proportion of the population engaged in various activities or to some ideal division of the national income. Rather it implies continuous change in these proportions as conditions change.

The decline in crop area per capita reflects not a decay of agriculture, but a wholesome adjustment to changed conditions. According to the Census Bureau, crop acreage increased by 45 million acres between 1909 and 1919, or nearly as rapidly as the population, whereas a continuation of the rate of increase characteristic of 1899–1909 would have caused an increase of only 23 million acres. Nearly half of the increase in the war decade was due primarily to extraordinary demands for export during the war. Between 1919 and 1924, according to the Census Bureau, crop acreage declined by 19 million acres.[1] The maintenance of even the 1899–1909 rate of increase would have brought the acreage to 13 million acres more than the recent census showed for 1924. The post-war decline is the result of three major forces: (1) the disappearance of most of the war-time demand for American agricultural products abroad; (2) reductions in domestic demand for agricultural products; and (3) increased efficiency in agricultural production. Reductions in domestic demand are due in large measure to industrial developments, notably the replacement of horses by automobiles, and to reduced per capita consumption of staple foods produced in America.[2] The reported reduction in horses and mules alone, in farms and in cities, between 1920 and 1925, is officially stated by the Department of Agriculture to have released for other uses some 9½ million acres. The influence of this factor is bound to be felt in later years.[3]

Now reduced food consumption per capita, changes in the diet, substitution of the automobile for the horse, increased efficiency, even the return of peace,

[1] This is probably an overstatement, for there is reason to believe the recent census appreciably incomplete.

[2] See "The Decline in Per Capita Consumption of Flour in the United States," *Wheat Studies of the Food Research Institute*, July 1926, II, pp. 265–292.

[3] On this paragraph, see O. E. Baker, *Changes in the Utilization of Land in the United States, 1919–1924*. Department of Agriculture, June 1926.

are in no sense to be deplored; on the contrary, they represent wholesome economic changes. In so far as they reduce the land, capital, and labor requirement in American agriculture, they inevitably involve a decrease in the relative importance of agriculture in the national economy. In itself this is no evil, and it portends no evil destiny; but it does mean that agriculture has latterly faced a trying problem of readjustment, the more serious because of synchronous reductions in foreign and domestic demand in the post-war period.

"The downward trend of exports and the rise of imports of agricultural products since 1900"—interrupted temporarily by the war—is a natural and by no means unwholesome consequence of such developments at home and the rise of newer agricultural areas abroad. We could doubtless grow all our sugar, our wool, our vegetable oils at home, and produce a huge export surplus of wheat and beef as well as of cotton and pork; but only at heavy cost. To attempt to do so, however, would create economic maladjustments, not reduce them. Instead we tend to export heavily of the products of large-scale industry in which our economic genius is more effective than in agriculture. Increases in imports of agricultural products are in large part due to higher standards of living and increasing diversification and expansion of industry. Before the war, such changes in the character of our international trade were not inconsistent with prosperity in agriculture. Though the reversal of war-time tendencies was no small factor in causing the post-war depression, the resumption of the pre-war trends implies no long-continued depression in agriculture.

"The rapid rise in capital, labor and operating costs relative to the price per unit of product since 1900" is not convincingly shown. The point is made partly by inference from evidence showing declines in farm land, improved land, and crop land acreage, in crop production and exports, per capita, since 1900. The validity of the evidence is open to some question, because of inaccuracies in Census and Department of Agriculture data on acreage and production, especially in the decade 1889–99;[1] and because the use of 3-year averages centering in census years (apparently choosing the wrong year, *e. g.*, 1880 instead of 1879) gives an inadequate picture of the trend of agricultural production. Even so, Table 9 (p. 32) shows a rising, not a declining, trend of agricultural production per capita throughout the pre-war period as well as a substantial rise in product per capita of agricultural working population. When one considers the factors influencing per capita acreage, partially discussed above, and the further fact that agricultural land appreciated substantially in 1900–10 (and presumably also in 1910–14) even in terms of 1913 dollars (see p. 40), one cannot accept the inference that agricultural costs, properly considered, were rising before the war in relation to agricultural prices and causing reduced returns to farming; or that they were responsible for declines in acreage per capita.

A serious error in reasoning about costs is introduced by the handling of "capital charges"—including "interest, at prevailing rates for time loans, on operators' investment." These costs, which contribute most heavily to the un-

[1] See "Wheat Acreage and Production in the United States Since 1866," *Wheat Studies of the Food Research Institute*, June 1926, II, pp. 237–264.

favorable conclusion reached, are calculated not on the actual investment by farm operators, for which no data can be had, but on land values presumably containing substantial increments of appreciation over and above actual investment. The result is an inflation of costs, such as would be promptly recognized if the same procedure were applied in the case of public utility companies. On the other hand, the increments in land values are not reckoned as income, though certainly rising land values before the war explain why many farmers were content with a modest rate of *current* return. In recent years, by contrast, reductions in current return to farmers have been the more serious because they have been accompanied by declining land values. The statistical procedure employed, therefore, distorts the conclusions about both pre-war and post-war periods.

The more detailed statistical evidence on costs, prices, and income—unsatisfactory at best—relates largely to the period 1914–25. This tends to show that during the war years farm prices and incomes expanded more rapidly than costs, and that costs declined less than prices in 1920–21 and have since increased more slowly. The use of 1914 as a base year (as in Charts 13 and 14, pp. 106, 109) probably tends in itself to portray the recent contrast too darkly, since there is reason to believe that farm prices were relatively favorable in the base year; but in view of the land value changes mentioned above, some such conclusion about this period is clearly justified. But the data are significant primarily for their indications of agricultural cycles, not of agricultural trends.

The analysis of costs and income is perhaps necessarily superficial, but a bias in interpretation is apparent. The competition of industry for labor and restriction of immigration do not "make farming more costly and harder," but make for increased use of machinery that reduces both cost and toil, as the report only grudgingly admits. In respect to the tax burden on farmers, no consideration is given to the degree to which higher taxes go for improvements, such as better roads, that reduce farm costs, or mean a higher standard of living, such as better roads and schools; or to the advantage the farmer has reaped in paying but a small proportion of the taxes assessed directly for war purposes (*e. g.*, federal income and excess profits taxes). The years 1922, 1923, and 1924, for which costs (including interest on land values) and prices per bushel of wheat, corn, and oats are compared, are erroneously cited as favorable years: at most only 1923 for corn and 1924 for wheat and oats can be called favorable. The influence of foreign demand and supply on prices of American farm products is by no means consistently unfavorable, as the discussion seems to imply: in some years, as in 1924–25, it is distinctly favorable.

"The rapid increase in the rate of farm bankruptcies as compared with that of commercial failures since pre-war years" reflects no basic trend or condition, but rather the severity of the recent agricultural depression. Even so, Chart 11 (p. 62) exaggerates, by its choice of scales, the unfavorable position of the farmer in recent years.

"The disparity between the return for investment and labor in agriculture and that in other activities" is unquestioned if one speaks in monetary terms, deals in broad averages, and ignores non-agricultural incomes of farmers and unemployment of wage earners. It is less impressive if one takes account of

increases in land values before and during the war. Furthermore, as a member of the Board's Advisory Committee on Agriculture has pointed out, averages per farmer which include a large number of operators who combine farming with other occupations—either doing outside work in otherwise idle time or farming as a side line—quite understate even the pecuniary returns of the farmer as an individual.[1] So far as the disparity exists, however, it results in large part from the intangible attractions of agriculture, and the fact that farming is in part a way of living and rarely a business or employment offering large financial returns. No reliable index of real incomes of farmers that is comparable with those of non-farmers of any group has yet been devised. The use of the dollar measure greatly exaggerates the disparity between per capita income of farmers and non-farmers; in so far as the farmer produces what he consumes and his consumption requirements are simpler, his dollar goes much farther than that of an urban worker or business man. Those who desire large dollar incomes wisely desert agriculture, and if financial returns of farmers could be boosted and kept on a level corresponding to that in other lines, the drift of population into agriculture would be enormous.

In a word, the fundamental weakness of the Conference Board's report is one of interpretation, of reasoning, though errors in statistical procedure are not lacking. The evidence substantiates the undoubted fact that, since the war, American agriculture has suffered severe depression and faced serious problems of adjustment to changed conditions; but the evidence does not support the central thesis that agriculture has long been confronted "with fundamentally adverse conditions, making for a general and persistent inequity and maladjustment." In seeking to establish the thesis of fundamental maladjustment of long standing, the report largely ignores substantial evidence that in pre-war years American farmers were prosperous and knew it, despite their low money incomes, the decline in agricultural exports, the increase of agricultural imports, and the rise of foreign competition; at the same time it lays too little stress on the recent agricultural depression and the progress in recovery since 1921. It misinterprets the continuous process of readjustment, within agriculture and between agriculture and industry, which is a necessary condition of sound national development.

If these criticisms are well founded, the report cannot safely be taken as an authoritative basis for recommendations of measures for agricultural relief and advancement.

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[1] See *The Agricultural Review*, July, 1926, p. 4, August, 1926, pp. 3–4. As Mr. Drummond points out, there is no ground for a broad assertion "that the farmer who works at other employment does so from necessity." Nor would a further division of the labor of individuals between farming and other occupations, such as Mr. Ford has proposed, imply the existence of unwholesome economic conditions in agriculture.

Income in the Various States: Its Sources and Distribution, 1919, 1920, and 1921, by Maurice Leven and assistants, of the National Bureau of Economic Research, Inc. New York: National Bureau of Economic Research, Inc. 1925. 306 pp.

Following an excellent "preliminary statement" by Dr. W. I. King concerning the estimates of the income of the United States upon which the special study is based, this volume offers a lucid and reasonably full account of the difficulties which were encountered in apportioning the national totals among the several states, the methods employed, and the results. The report may be said to fall into three main divisions, corresponding to the general plan by which the work of the study was broken up. In the first place (Chapters II–VI, pp. 49–130) is considered the distribution of wages and salaries by states—separate data being compiled in the process for the five fields: (1) manufacturing; (2) mines, quarries, and oil wells; (3) agriculture; (4) construction; (5) trade, transportation, and miscellaneous. Next we find (Chapters VII–IX, pp. 131–218) a discussion of the statal allocation of agricultural receipts, expenses, and income. In the third place (Chapters X and XI, pp. 219–247), the apportionment of entrepreneurial and property income is dealt with. The final chapter of fifty-three pages is devoted to summary and analysis.

Some phases of the subject seem to be slighted, and others are dealt with at relatively great length. For example, there is no explicit and separate consideration of forestry and lumbering, although the relatively minor question of horses and mules raised on the farm is given ten pages. However, in many cases the apparent lack of proportion in treatment is doubtless due to disparity in underlying data as applied to various topics. In the main the material is well organized. The style is somewhat monotonous, but this need not be surprising in view of the nature of the report. The tabular and graphic exhibits are intelligible and appear to have been set up with great care. (Incidentally, the reviewer was surprised to find the Upper Peninsula of Michigan unshaded in each of the several maps in Chapter XI; nevertheless, this may be correct.)

This study endeavors to answer the question, where is the national income received? rather than, where is the income produced? In the opinion of the reviewer this is its greatest weakness. Doubtless a distribution of national totals by states from the standpoint of income recipients is worth while, but it would seem that an allocation in terms of production would be more significant (except, perhaps, in connection with marketing research). It might well be contended that to the extent that the figures here obtained are really significant this is due to the fact that in most states there is no great difference between income produced and income received therein. If a half dozen of our leading millionaires should become residents of North Dakota, Vermont, and Mississippi, for example, the total incomes received in these states would be increased in spectacular fashion and the resulting figures would be quite misleading and of very dubious value. Further, a geographical allocation of income in terms of production would be on a more clear-cut, consistent, and dependable statistical basis. As it is, Mr. Leven determines the income of farmers by states through

a straightforward (though somewhat incomplete) accounting for output and expenses, but in the case of security holders and owners of all other property he shifts to methods of apportionment which are designed to exhibit income as received, regardless of origin, and in which so many arbitrary and rough estimates and guesses are employed as to make one fearful for the reasonableness of the final figures. Why not determine the income of each state in terms of: (1) the output of its mines, forests, farms, and other extractive lines (with or without considering allowances for depletion, as desired); (2) the product of its manufacturing plants and related industries, proper deduction being made for the cost of materials consumed; (3) the gross sales of trading concerns less merchandise cost of sales; (4) the revenues of public utilities less cost of materials and supplies; (5) the earnings of banking and other financial concerns; and (6) the estimated value of the services of the professions and the other personal service lines? That is, why not treat each state as a large, integrated business enterprise, the income of which is to be accounted for as is the earning power of any large corporation through the mechanism of consolidated statements and the elimination of inter-industry items?

The reviewer recognizes that such a shift in point of view would not eliminate all difficulties in the way of the compilation of satisfactory income figures. Indeed, it would be virtually impossible to determine the production of national income by states in any ultimate sense. The Bureau of Internal Revenue, it is true, has the temerity to attempt a geographical allocation of income in the case of earnings "derived from sources partly within and partly without the United States," but a perusal of the regulations of the commissioner covering this matter should be sufficient to convince anyone of the extreme difficulty of demonstrating the situs of income creation in the case of transactions which ignore boundary lines. As a practical matter the state should be credited within whose limits the commodity is consigned or the service furnished. In the case of such industries as railroads engaged in interstate traffic a more or less arbitrary apportionment of revenues would be required.

It might appear at first sight that an apportionment of income by states from the standpoint of production would not furnish as satisfactory a basis for per capita figures, comparisons being urban and rural income, and so on, as an allocation from the standpoint of the residence of ultimate recipients. As indicated above, however, there is reason for holding that a determination of income by states in the sense of producing units would in most cases yield reasonable figures for income received within the state; and such a determination would not preclude the use of special supplementary studies and adjustments designed to bring out particular items of interest as to conditions between different sections of the country.

A work of this kind naturally arouses many criticisms in the mind of the reader, both favorable and unfavorable. The book is noteworthy for rational points of view and clear-cut analysis, and—as in the other works in this series—the more or less arbitrary conventions of accounting and the law, which seriously interfere with the determination of economically significant income figures in the case of the single business enterprise, are for the most part ignored. Particularly

praiseworthy is the attempt to deal with the effects of changes in the value of inventories, and the recognition throughout of the effect of the changing value of money. Accountants might well take heed. Mention may also be made of the adoption of the view (p. 180 and elsewhere) that the long-term creditor as an investor and a participant in the earnings of an enterprise is in a position fundamentally comparable with that of the stockholder or other proprietor, so-called, and the recognition (p. 220 and elsewhere) of the impropriety of any effort to divide the personal and business earnings into their underlying economic components *as a part of the process of measuring income itself*. In the opinion of the reviewer these positions are very well taken.

The author says (p. 247) that the "logic of including imputed rent of owned homes can hardly be disputed," and he goes on to the conclusion that imputed interest on the value of durable consumers' goods such as clothing and furniture should also be counted. To the reviewer this whole proposition seems to be debatable. The inclusion of such elements, for one thing, carries us into a field quite apart from that of the market, with its objective standards of prices actually determined and adopted, and introduces another conception of income. Further, does not this procedure in a sense involve duplication? Suppose, for example, that a man earns $75 as wages and then spends this sum for a suit of clothes. Is his true income $75 plus interest on this sum for the period of the use of the suit? In the last analysis, of course, his effective income is the significance of the use of the suit; but is this to be measured by some figure other than cost? If the value of the use is counted, should not the amount of the original expenditure be omitted? Does one receive more income when he spends his money for something durable, such as a painting, than when he spends the same sum for gasoline on a pleasure trip? Is not income for purposes of this study the net amount of purchasing power accruing as a result of furnishing marketed or marketable services, or conditions, regardless of whether such income is thereafter added to capital, expended for durable consumers' goods, or expended for short-lived goods? At any rate, if interest on durable consumers' goods were treated as an element of income, in addition to all items of money (or equivalent) income as originally received, it seems clear that it would be necessary (in the individual case) to apply the estimated rate to successively depreciated values throughout the life of such goods—a fact which emphasizes the unsatisfactory and questionable character of any such calculation.

In this connection it may be noted that the author does not make it sufficiently clear, in speaking of rent incomes, actual and imputed, that the effective element is obtained after the deduction of maintenance, depreciation, insurance, and taxes.

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American Villagers, by C. Luther Fry; with an appendix on the *Social Composition of the Rural Population of the United States*, by Luther Sheeleigh Cressman. New York: George H. Doran Company. 1926. 201 pp.

The body of this book is devoted to an analysis of the social composition of the population in 177 agricultural villages for which Dr. Fry of the Institute of Social and Religious Research undertook special tabulations in order to get details for them comparable with those available for larger urban centers. This material had been previously published in pamphlet form, separately, for the different parts of the country. Hence there is nothing new in the part of this book describing these villages.

This special tabulation does show beyond doubt that villages in general, and agricultural villages in particular, are quite likely to have certain peculiarities in their social composition. For example, (a) they have more old people than the cities or the open country; (b) except in the Middle Atlantic states, they have more children under 10 per 100 married women than the cities with which they are compared, but fewer than the open country; (c) in general, a larger proportion of their white population is native than elsewhere; (d) except in the South, they have fewer males than either the open country or the cities; (e) they are likely to have more married males than cities or the open country (particularly the latter), while the females are married to about the same extent in the cities and villages, but much more in the open country than in the villages; (f) the villages also have a very high proportion of widowed women, much in excess of other groups. There are other distinctive features such as the composition of the occupational groups and the insufficiency of the medical and dental practitioners in "country communities" which deserve discussion, but can merely be mentioned here.

One cannot refrain from wishing, however, that with the age and sex data for particular villages at Dr. Fry's disposal, he had taken some account of the effect of this inadequate medical service on the village death-rates.

Two conclusions, (a) that the villages are more like certain cities than the open country (with qualifications), and (b) that they are growing in numbers faster than the open country may be questioned by some, although the reviewer accepts them (perhaps more through personal knowledge of conditions than because of facts here adduced).

Several caveats must be entered. The reviewer deems it a serious mistake that 56 of the 177 villages were county seats. They are represented out of all proportion to their importance and are distinctly atypical in many respects. The most surprising thing about the book, however, is its attempt, particularly in Dr. Cressman's appendix as well as in Chapters II and III, to discuss open country population without reference to the Census data on "farm population." One can scarcely believe that Dr. Fry and Dr. Cressman are both ignorant of its existence, and yet no other reason can be assigned for the failure to use it. How far this vitiates the comparisons of villages and open country cannot be said, but when the open country population is estimated at approximately 39,000,000 against a census count of farm population of 31,614,000, the dis-

crepancy cannot be accounted for by the inclusion of villages of less than 250 in the former estimate nor by non-farm population living in the open country. Furthermore, in view of the fact that it is common knowledge that the Census is issuing a monograph on "Farm Population" by Mr. Leon E. Truesdell, this oversight seems inexcusable.

Various statistical practices as well as deductions from data might well be criticised, for example, the statement that the difference between 22.0 per cent and 20.0 per cent in the proportion of males in the open country and in villages (this is a 10 per cent difference) is "so small that it is virtually negligible" (p. 162), and the discussion of the number of pupils to teachers living in the villages with no knowledge of how many such teachers serve strictly rural schools (pp. 115, 116). Space does not permit the citing of any more.

With the general conclusion of both the authors that the village population has so many distinctive features that the Census should tabulate it separately, the reviewer is in full agreement; he only regrets that better use was not made of the data available to establish their case, that the statistical practices at certain points were not more water-tight, and that the deductions at several points show very loose thinking and lack of personal knowledge of the conditions discussed. The book should serve a useful purpose, however, in helping to stimulate interest in getting more Census details regarding a relatively neglected part of our population.

WARREN S. THOMPSON

Business Annals, by Willard Long Thorp. With an Introductory Chapter by Wesley C. Mitchell and a Foreword by Edwin F. Gay. New York: National Bureau of Economic Research. 1926. 380 pp.

This is the eighth publication of the National Bureau of Economic Research, and the third of its studies of the business cycle. The Annals proper comprise a highly condensed summary of the changes in business activity in each of 17 countries. In the cases of the United States and England the narrative is carried back to 1790; the French Annals go back to 1840; the German to 1853; the Austrian to 1867; and for the other 12 countries the narrative starts with 1890. All the Annals terminate with 1925. In addition to the Annals proper there is a detailed introduction and analysis by Professor Wesley C. Mitchell. There is an excellent bibliography.

Each Annal consists of five paragraphs. The first is a phrase summarizing the year as one of recession, depression, revival, or prosperity. In the majority of cases the year's activity is summarized in a single word, but when there was a marked change in the pace of business during a year, two or even three stages are distinguished, and there is an occasional qualification by some such adjective as "mild," "temporary," or "halting." The second and the third paragraphs of each Annal deal respectively with commercial and industrial activity, and with conditions in the financial and security markets. The fourth paragraph deals with agricultural conditions, and the fifth with facts not strictly of a busi-

ness character, chiefly political events. These paragraphs vary in length from two or three words to five lines.

Judgments will differ occasionally as to the proper designation of a given period, and much more frequently as to the desirability of including a given item in the later paragraphs of the Annal, especially the fifth. The author's effort was to include in this last section phenomena which "may have exercised influence upon the conditions of business." Such summaries might be useful either as a check on theories of the causation of the cycle, or as a source from which to glean suggestions for evolving such a theory. Their scope is necessarily determined, however, by the author's ideas as to what external phenomena are most likely to change the course of business activity, and their value for testing rival ideas is therefore limited.

With reference to the United States, for example, there is no mention of gold imports in any year since 1914, nor of the return of American securities during the early years of the European war, nor of the loans by our Government to the Allies (except the debt settlements in 1923 and 1925); nor of private loans to foreign countries, except in 1925. There is no reference to income or excess profits taxes, or to the expansion of state and municipal borrowings. For recent years there is no mention of "hand to mouth buying," installment selling, the road-building boom, the extraordinary increase in the efficiency of the service rendered by the railroads, or changes in rediscount rates or open market operations of the Federal Reserve Banks. Yet all these have been suggested by prominent writers as factors directly affecting the degree of business activity. Of course, the compressed character of the Annals necessitates omission of some relevant items, but such gaps as these seem unfortunate, since space was found for the controversy over our entry into the League of Nations, the Women's Suffrage Amendment, the Disarmament Conference, the disallowance of the Federal Child Labor Tax Law, the death of Harding, and the oil scandals.

From the standpoint of accuracy the volume maintains, so far as the reviewer can tell, the high standard which has been set by other Bureau publications, except in the references to the crop out-turn and prices of Brazilian coffee, where the facts are seriously jumbled. The enormous crop of 1901 is incorrectly stated to have been sold at rising prices. The crop of 1903, the smallest, with one exception, between 1899 and 1918, is described as "good." The crop of 1919, the smallest since 1895, is described as good; that of 1920, nearly twice as large, is recorded as poor. The statement that frost killed half the coffee-bearing trees in 1918 is obviously inconsistent with the record of production in the years after 1919. For 1905 it is stated that "poor coffee crop at low price causes great distress;" in fact the total (gold) value of this crop had been exceeded only once or twice previously.

Professor Mitchell's Introduction includes not only an introduction in the ordinary sense, which describes the character and sources of the Annals and the uses which may be made of them, but also an extended analysis and interpretation of the facts. Three principal problems are studied: the length of the cycle, the relative length of its several phases, and the international relationships. This analysis is not affected by any inadequacies or inaccuracies of the de-

tails of the fuller Annals, as it rests entirely on the summary designations of the successive years as periods of depression, revival, prosperity and recession. Moreover, a considerable part of it rests simply on the recessions, which are taken to mark the boundaries of successive cycles. As recession is the subject of wider comment than is any other phase of the cycle, a high degree of confidence can be placed in these results.

Dr. Mitchell's conclusions are not only significant in themselves but are extremely encouraging evidence of the possibility of applying the quantitative method to data which do not themselves run in quantitative terms. By more or less arbitrarily chopping up business history into calendar years, and using a summary classification, it has been possible to tabulate the data and throw them into frequency distributions which tell much more than a first inspection of the raw data would lead us to believe possible.

The conclusions reached are too numerous to be listed here, but some of the more interesting may be indicated. A three-year cycle (corresponding roughly to the 40- or 42-month cycle found by several investigators) is found to be highly characteristic of American experience, but not of that of most other countries. Long cycles are marked by a higher proportion of depression years; in short cycles prosperity eras predominate. No evidence is found to show that the length of the cycle is changing. As countries develop a more complex industrial system, their cycles come more and more to display a common pattern. Since 1890 divergences from the international pattern have resulted chiefly from the intercalation of local disturbances between the recessions in which other countries share. Where a country misses an international recession it is usually because it is already in a state of local depression.

Economists and statisticians will await with interest the publications of the promised volumes in which Professor Mitchell is to correlate the conclusions drawn from the Annals with those derived from the study of the narrower but more precise information contained in the statistical series which the Bureau of Economic Research and other agencies have been gathering.

CHARLES O. HARDY

Institute of Economics

Statistics as Applied in Business, by Benjamin Franklin Young, M.A. New York: Ronald Press Company. 1925. xii, 639 pp.

This is an elementary textbook of statistics. It is addressed to "practical business men" and "students of commerce preparing for a business career." It is clearly intended for a particular portion, however large, of this group, for all purpose to treat with any thoroughness the theory of the subject is repeatedly disclaimed. As the title implies, the emphasis is on application. The preface indicates that the volume will describe the procedure to be followed in building up and directing a statistical service in a business establishment. Although this expectation is not realized, the common uses of statistics in the operation of business establishments are stressed throughout, and Part I, Collecting and

Assembling Business Facts, gives a very detailed, if somewhat tedious, account of the internal and external facts which might have to be compiled in the statistical office of a large business concern, which should be of considerable value in setting up such a service. This is the largest section of the book, comprising 200 pages. The other parts are as follows: (II) Organizing Basic Records, 20 pp.; (III) Presenting Statistical Data, 122 pp.; (IV) Analysis and Interpretation of Statistical Data, 140 pp.; (V) Miscellaneous, 46 pp.

There are also six appendices, including: a glossary; a table of facts relating to selected index numbers; suggested forms for compiling data; tables of logarithms and anti-logarithms; directions for making certain computations; and a long list of questions and problems arranged to correspond with the text.

The space devoted to methods of analysis is too small for adequate explanation of the methods included. The subject of index numbers is thus disposed of in fifteen pages, time series and their analysis in thirteen pages, and correlation in seven pages. Exception might be taken to the position of the author on various points. For example, distinction is painstakingly made between *original* and *primary* sources of data. ". . . the original source is the field of observations, the primary source is the agent who makes the original observations." Since data are, in fact, created in the process of observation, this distinction seems unnecessary and misleading. It is stated that average deviation is "invariably" measured from the *arithmetic average*. Index numbers are described as being "fundamentally" a device designed to reduce different series of data to comparable bases.

There are frequent evidences of haste in the publication of the book, including misspelled and misused words and poorly constructed sentences. Two words, "practical" and "developed," are grievously overworked. The book contains a large amount of information, for the most part simply presented. Particularly, the first part is of a sort to which much attention is not given in most statistical textbooks.

RALPH G. HURLIN

Russell Sage Foundation

Maternal Mortality, by Robert Morse Woodbury. Bulletin No. 158 of the Children's Bureau, United States Department of Labor. Washington: Government Printing Office. 1926. 163 pp.

More than eight years ago the Children's Bureau issued a monograph on maternal mortality under the authorship of the late Dr. Grace L. Meigs-Crowder. This publication had a marked influence in arousing nation-wide interest in the prevention of mortality in childbirth. It stimulated also the development of public health nursing for parturient women, the establishment of adequate obstetrical hospital facilities, the enactment of the Sheppard-Towner Act and a number of other important and productive efforts for conserving the lives of mothers and very young infants. The present monograph manifests the continued interest of the Children's Bureau in this important problem, and

will serve, also, to remind the public health movement of the pioneer services of Dr. Meigs-Crowder and her associates in behalf of American women and children.

In this second study, Dr. Woodbury has taken great care to indicate the extent to which real meaning can be extracted from the published figures relating to puerperal mortality. The first 21 pages present a better outline of the registration and nosological difficulties in the way of adequate display of facts on maternal mortality than has appeared in any recent publication on the subject. In fact, Dr. Woodbury's technical observations could very well be incorporated in the next revision of our current texts on vital statistics. For the repleteness of the technical introduction Dr. Woodbury is no doubt indebted in part to the counsel offered by Drs. Meigs-Crowder, Williams, Howard, Davis, Willcox and Adair. Material errors in the real risk-rate of childbearing as measured by the ratio "deaths-from-puerperal-causes÷total pregnancies" arise out of failure to register births, still-births, miscarriages and abortions, and deaths. Complicating the situation we have vague and indefinite certification of the causes of death, changes for the better with passing years in the certification of these causes, necessary changes in classification procedure with each revision of the International List of Causes of Death and in the office treatment of jointly returned causes, the decline in mortality from diseases which, when formerly returned jointly with puerperal conditions, took preference in the final allocation of the death on statistical registers, etc. Dr. Woodbury has shown on pages 6 to 21 approximately the allowance which should be made for most of these important conditionary factors. He concludes that the number of deaths assigned to puerperal causes fell short of the true number by as much as 12 per cent, and that there was a deficiency of approximately the same proportion in the number of confinements. The maternal mortality rate for the birth registration area as calculated from registered deaths classified as puerperal and from registered live-births, therefore, is probably not far from correct.

In the next chapter, there appears a collection of historical tables which utilize the Census Bureau's two consolidations of mortality data for the period 1900 to 1921, by states. In Table 35, index numbers of the maternal mortality rate are given for the period 1900 to 1921, with due allowance for a falling birth-rate. For the period 1911 to 1921, Table 36 shows index numbers with allowance for the effect on the rates of letters of inquiry to physicians. Much useful information on maternal mortality rates in foreign countries is also shown in several sections of the work. Table 43 on puerperal sepsis in Norway from 1876 to 1918 calls to mind the early work of Semmelweiss of Vienna in 1847. Working with the clinical and statistical materials of the lying-in hospital in Vienna, Semmelweiss developed his doctrine of the prophylaxis of puerperal fever. This pioneer work was made known to the world by Dr. Augustus Hirsch, Professor of Medicine at the University of Berlin, to whom (and to Semmelweiss) mankind at large is indebted for the prevailing practices which reduce the risk to mothers of one of the most painful and lethal diseases known to medicine. The communicable nature of puerperal fever appears to have been brought to the attention of the

medical profession as early as 1682 by the great Willis,[1] who introduced the term "febris puerperarium," and undertook a searching clinical and statistical inquiry into the causes of the disease. He even went so far as to connect the origin of the disease with laceration of the genitals during labor and to refer to it as a "miasma venenatum." After Willis, came Strother (*Critical Essay on Fevers*, 1718), Hoffman (1748) and others.

Dr. Woodbury's data in Table 38 tend to show that in the death registration states the mortality from puerperal sepsis actually decreased from 1900 to 1920, while that from other puerperal causes remains approximately the same. The estimated rate (p. 55) was 4.3 deaths from puerperal fever per 1,000 live-births in 1900 and 2.7 per 1,000 in 1920. In order to appreciate what progress has been made since Semmelweiss' time, this latter figure may be compared with the rate of 30 sepsis deaths per 1,000 confinements in the St. Petersburg Lying-in-Hospital for the period 1845–1859, and with the record of the Vienna Allgemeine Gebärhaus, 50 deaths per 1,000 confinements for the years 1840 to 1863. That further progress can be made in the United States is suggested by the low figure of 0.80 deaths per 1,000 shown by Dr. Woodbury for Norway in 1918.

It is hoped that the dissemination and use of this monograph will revive nation-wide interest in the provision of adequate care for parturient women. Further studies could be made with profit by other students, especially in developing for specific local areas the facts which lead to constructive local action. As Dr. Woodbury points out, there are opportunities for the local collection of data on the number and nature of obstetrical operations, the results when births are attended in hospital or at home and by physicians or midwives. There is ever present the problem of securing registration of live-births, stillbirths, abortions and miscarriages, and of deaths of mothers. Data should also be displayed by age, nativity and social status of mothers in line with the tabular program of the Census Bureau for the Birth Registration Area. Productive studies may also be made in the epidemiology of puerperal sepsis, its seasonal incidence and relation to other prevailing infections such as scarlet fever.

E. W. Kopf

Dollar Diplomacy: A Study in American Imperialism, by Scott Nearing and Joseph Freeman. Huebsch and The Viking Press. 1926. 353 pp.

This is a valuable study of the expansion of American economic and, especially, financial interests outside the limits of the Continental United States, and of the official encouragement and assistance given to such expansion, through diplomacy and, in some cases where this did not suffice, through the use of the military and naval forces. It makes use of a great mass of detailed information bearing on the subject, and it is as a compilation of such material that the book is of most value. There is little attempt to go beyond the colorless statement of facts to an interpretation or appraisal of their ethical or economic significance, but there is an implied adverse criticism of the whole trend of American devel-

[1] *De Febribus*, Chapter XVI, p. 212. 1682.

opment in its economic relationships with weaker countries in the choice of such invidious terms as "dollar diplomacy" and "economic imperialism" as descriptive of what has practically become the routine procedure of American diplomacy and business. The main significance of the story here told, as I see it, is the familiar one that when strong and weak countries develop intimate economic relationships with each other, the weak countries have occasion at times to rue their weakness. The authors have exercised great restraint in refraining from saying so. On some matters they have overlooked material which would have put their self-restraint to an even more severe test. But they have made an important contribution toward the task of preparing and analyzing the materials necessary for an understanding and appraisal of a significant phase of recent American history.

JACOB VINER

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A First Course in Statistical Method, by G. Irving Gavett. New York: McGraw-Hill Book Company, Inc. 1926. vi, 358 pp.

This book does not give the student the usual setting of generalities. By presenting an actual example the reader is at once forced to think in concrete terms, and the questions following the various paragraphs make the student realize that he has entered very suddenly into the full swim of things.

The author's pedagogic intentions might seem obscure to students who are used to offer more inertia to the mental consumption of such subjects as these, and who are accustomed to a more leisurely preparation. However, closer consideration might show that this form of introductory procedure has a certain psychological value. There is an innate elementary feeling for classification in the statistical sense in most minds, especially since in these days it is hardly possible to go through a day's work without coming into contact consciously or unconsciously with the spirit of classification in one way or another. Viewed in this light, Mr. Gavett has the argument for his particular approach of the subject on his side. Granted that the student does not enter at once into the refinements and possibilities of the material offered, nevertheless, he will be impressed with the rough results which he is forced to work out for himself. To the intelligent student this will mean initial confidence in his own ability to cope with the future requirements. Thus the advantage gained for the pupil as well as for the instructor might compensate for the lack of a too careful ascending approach of the subject.

In Chapter II the author takes up the subjects of tabulation and frequency distribution. The elucidation of the subject is clear and Mr. Gavett sees fit, in full realization of things to come, to emphasize at once the statistical relation between frequency distribution and probability theorem. The presentation of chance distribution on the basis of theoretical symmetric binomial distribution as compared with actual distribution obtained by experiment must undoubtedly create a logical picture of this subject in the reader's mind.

Chapter III, which is entitled "Graphical Presentation-Frequency Graphs," is written more in terms of analytic geometry than from the point of view of the usual interpretation of the title graphical presentation. The character of the book justifies this attitude. After all, the Cartesian geometry contains all the fundamental features of graphic presentation as applied by the statistical science. For the purpose of statistical analysis it is important for the student to remember that curves can be expressed in algebraic form and vice versa. A thorough schooling in the principles of analytic geometry is the best foundation for a wider and deeper appreciation and understanding of graphic presentation, as without it, the latent value of the curve is never fully realized.

Logarithmic graphical representation is taken up in Chapter X. The subject is presented in clear style; very fittingly the author discusses the valuation of the logarithmic least squares line. A paragraph on forecasting is included. The author cautions the student against depending too much on trend lines. The warning might have been expressed in the words of Henri Bergson: "For to foresee consists of projecting into the future what has been perceived in the past, or of imagining for a later time a new grouping, in a new order, of elements already perceived. But that which has never been perceived, and which is at the same time simple, is necessarily unforseeable."[1] At the end of this chapter the reader will find a sufficient number of examples, which, if worked out carefully, will add materially to his understanding of the ratio chart.

One of the most interesting chapters in any textbook on statistical methods should be that dealing with statistical averages. It goes without saying that authors of textbooks on statistical methods are forced to draw on mathematical tools to gain their position. The exposition of the theory of averages in most textbooks—and the present is no exception—centers naturally around the application of the customary formulas of quantitative analysis. The effect of the computed result of a formula has something pleasing for the student; he feels, even within limited premises, that he has attained a desirable goal by "solving for x." This satisfaction is perhaps most fittingly expressed in Goethe's *Faust* by the words of the pupil to Mephisto when the former, asking for advice, says: "Denn was man schwarz auf weiss besitzt, kann man getrost nach Hause tragen." This attitude of "taken it home safely" should be discouraged in the *status nascendi* by giving the pupil a sense of proportion which will prevent him from regarding his findings with too much finality. A sense should be developed of weighing statistical results by injecting a philosophical catalysis either directly into the fabric of the text, or indirectly by a bibliography of collateral readings referring to such essays as:

Venn's "On the Nature and Use of Averages," *Journal of the Royal Statistical Society*, 1891;

Edgeworth's "On Methods of Statistics," *Jubilee Volume of the Royal Statistical Society*, 1885, p. 182;

Raymond Pearl's "On the Nature of Statistical Knowledge," *Modes of Research in Genetics*, Macmillan Co., 1915, p. 73;

and many more. The incentive to such treatment is so much more inviting as

[1] Henri Bergson: *Creative Evolution*, p. 6, Henry Holt and Company, New York.

the American and English statistical literature contains a wealth of sources along these lines. Perhaps Mr. Gavett has for pedagogical reasons as well as for reasons of space economy abstained from such treatment, but I feel that the more ambitious student would welcome an opportunity, which if presented, would offer him greater penetration.

The exposition of Chapter IV is clear, although a few more diagrams might have been a valuable asset.

The Chapters V, VI, and VII, which deal in consecutive order with dispersion, skewness and probable error, may be considered extensions of Chapter IV. Diagrams, as the author has shown on page 131, are very helpful and accelerate the process of learning.

Parallels from other branches of science are always stimulating in forming a clear concept of what one is about to absorb; the student will, therefore, be interested to read the mechanical interpretation of the standard deviation in paragraph 15. To those who are familiar with the subject of higher mechanics the author shows how dependent different branches of science are upon each other for the interchange and application of certain principles. It is just such aspect of exchange and reciprocal use which furnishes food for further thought and research.

Curve fitting, correlation, regression and index numbers are given in the following chapters and are discussed in great detail. For his mathematical equipment the student may draw upon the appendix on such subjects as the theory of logarithms, permutations, combinations, binomial expansion, the laws of probability, and finally the theory of the differential quotient.

The publishers deserve much credit for the diligence and care they have taken to make Mr. Gavett's *First Course in Statistical Method* such an attractive book.

Graphic Methods for Presenting Business Facts, by John R. Riggleman; Introduction by M. C. Rorty. New York: McGraw-Hill Book Co., Inc. 1926. xiii, 231 pp.

Put into the hands of those who are occupied with the task of making charts for publications, business reports, etc., Mr. Riggleman's book will find its place not only in the drafting-room but will also serve as a source of advice to those who want to inform themselves about the first steps to be taken to prepare a piece of statistical graphical presentation.

The text gives detailed information on the technique of drawing statistical diagrams and charts, furthermore on drawing equipment and its use, lettering by hand and by mechanical guides; in short it covers all the essential questions which may arise from the "ink bottle to the finished product."

The suggestions given here are not new and are found in several other textbooks. The author tries throughout the book to reach the draftsman's understanding of correct technique of presentation rather than a grasp of ultimate statistical interpretation. It is for this reason that the book contains only such mathematical information as is related directly to the making of charts, and it appears in simple terms.

On the whole, the diagrams are clear, and the *pro* and *contra* for one form of chart or the other are sufficiently discussed to prevent mistakes in graphic presentation within the elementary scope which the book covers.

R. VON HUHN

The Ratio Chart in Business, by Percy A. Bivens. New York: Codex Book Company. 1926. ix xxiii, 177 pp.

The author, in the Preface, states that the purpose of this volume is to further the use of the ratio chart "in problems of rates of change and to show that no technicalities enter into its industrial application." The book is addressed to the "average" business man—"that type, which without specialized training in business research, constitutes the administrative backbone of industry." On the whole, the author has accomplished his purpose, yet it is doubtful whether parts of the discussion, such, for instance, as Chapters V, VI, and VII, which refer, respectively, to Auxiliary Reading Scales, Stationery and Enumeration, and Design of Ratio Chart Stationery, will be comprehended by such an "average" man to whom—if the author is to be taken seriously—the calculation of a percentage is an occult act. These chapters, and certain parts of others, more fittingly meet the needs of statistical offices—the "doers"—than they do the executives whose prejudice against anything remotely suggestive of logarithms, the author is at pains repeatedly to point out.

The plan of the book is simple and the treatment straightforward. The volume abounds with charts around which the discussion centers, the useful device of contrasting the visual effect, and the interpretation which should be given to it when data are plotted on a "difference" and a "ratio" background, being frequently employed. The author, while reiterating time and again the essential characteristics of ratio charts as follows: "Equal vertical rises indicate equal rates of increase; . . . equal vertical drops indicate equal rates of decrease," does not limit his discussion to these points alone.

Moreover, he is careful to describe the types of problems to which ratio charts are applicable, and to illustrate those to which graphical measures of "rates of change" do not apply. This is a unique service which the author renders, inasmuch as not infrequently graphic devices of various types are indiscriminately used without any apparent evidence that those who draw them understand the important canon of good graphic practice that "statistical facts and their form of graphic representation should agree." By this particular group of "doers," and by those who set them tasks, this little book may well be carefully studied.

HORACE SECRIST

Northwestern University

RECENT LITERATURE

STATISTICAL BOOKS

ALBION, ROBERT G. *Forests and Sea Power.* Cambridge, Mass.: Harvard University Press. Harvard Economic Studies, Vol. 29. 1926. xv, 485 pp.

ARTMAN, CHARLES E. *Food Costs and City Consumers.* New York: Columbia University Press. 1926. 171 pp. (Columbia University Studies in History, Economics and Public Law.)

BRUMBAUGH, MARTIN A. *Direct Method of Determining Cyclical Fluctuations of Economic Data.* University of Pennsylvania. 1926. 73 pp.

COOMBS, WHITNEY. *The Wages of Unskilled Labor in Manufacturing Industries in the United States, 1890–1924.* New York: Columbia University Press. 1926. 163 pp. (Columbia University Studies in History, Economics and Public Law.)

FOOD RESEARCH INSTITUTE. *American Importation of Canadian Wheat.* Wheat Studies, Vol. III, No. 1. Stanford University, California. 76 pp.

——. *The World Wheat Situation, 1925–1926.* Wheat Studies, Vol. III, No. 2. 64 pp.

——. *Survey of the Wheat Situation, August to November, 1926.* Wheat Studies, Vol. III, No. 3. 37 pp.

GILLMAN, JOSEPH M. *Rent Levels and Their Causes.* University of Pittsburgh. 1926. xiii, 74 pp.

HURLIN, R. G. and BERRIDGE, W. A. *Employment Statistics for the United States.* New York: Russell Sage Foundation. 1926. xvi, 215 pp.

LEAGUE OF NATIONS. Health Organisation. *The Official Vital Statistics of the Republic of Portugal.* Statistical Handbooks Series: No. 7. 59 pp.

LINDSAY, KENNETH. *Social Progress and Educational Waste.* London: Routledge. 1926. 223 pp. (London School of Economics and Political Science.)

MOWRER, ERNEST R. *Family Disorganization.* Chicago: University of Chicago. 1927. xvii, 317 pp.

PIETRI-TONELLI, ALFONSO DE. *Traité d'Économie Rationnelle.* Paris: Marcel Giard. 1927. 639 pp.

REED, RUTH. *Negro Illegitimacy in New York City.* New York: Columbia University Press. 1926. 137 pp. (Columbia University Studies in History, Economics and Public Law.)

UNITED STATES SURGEON GENERAL'S OFFICE. The Medical Department of the United States Army in the World War. Vol. VI. *Sanitation.* Washington. 1926. 1141 pp.

——. Vol. XIV. *Medical Aspects of Gas Warfare.* 1926. 876 pp.

GOVERNMENT PUBLICATIONS

UNITED STATES.

—— Department of Labor.

Bureau of Labor Statistics:

No. 407. "Labor Cost of Production and Wages and Hours of Labor in the Paper Box-Board Industry."

No. 415. "Wholesale Prices, 1890 to 1925."

No. 416. "Hours and Earnings in Anthracite and Bituminous Coal Mining, 1922 and 1924."

No. 418. "Retail Prices, 1890 to 1925."

No. 419. "Trade Agreements, 1925."
No. 420. "Handbook of American Trade-Unions."
No. 428. "Proceedings of the Industrial Accident Prevention Conference, July 14–16, 1926."

Children's Bureau:
No. 162. "Public Aid to Mothers with Dependent Children."

Women's Bureau:
No. 52. "Lost Time and Labor Turnover in Cotton Mills."
No. 53. "The Status of Women in the Government Service in 1925."

—— Treasury Department.
Public Health Reports:
Vol. 41.
No. 42. "Death Rate from Tuberculosis Decreasing"; "Court Decisions Relating to Public Health"; "The Notifiable Diseases in Small Cities, 1925."
No. 49. "Health Studies of Negro Children."
No. 50. "The Work of the United States Public Health Service"; "Public Health Engineering Abstracts."

FOREIGN COUNTRIES.

England.
"Statistical Review of England and Wales for the Year 1925."
Part I, Medical. iii, 520 pp.
Part II, Civil. 125 pp.

France.
"Annuaire Statistique." Statistique Générale de la France. Ministère du Travail, de l'Hygiène, de l'Assistance et de la Prévoyance Sociales. Vol. 41. 1925. lxviii, 371 pp.

India.
"Statistical Abstract for British India." Calcutta: Government of India. 1926. xi, 683 pp.
"Report of the Committee of the Bengal Chamber of Commerce for 1925. Appendices." vi, 451 pp.

New Zealand.
"Report of the Vital Statistics of the Dominion of New Zealand for the Year 1925." xxxii, 258 pp.

Roumania.
"Annuaire Statistique de la Roumanie, 1925." Institut de Statistique Générale de l'État. xix, 297 pp.

South Australia.
"Statistical Register, 1923–24."
"Statistical Register, 1924–25."

Switzerland.
"Annuaire Statistique de la Suisse, 1925." Publié par le Bureau Fédéral de Statistique. 1926. xx, 330 pp.
"Recensement Fédéral de la Population du 1 Décembre 1920." Publié par le Bureau Fédéral de Statistique. 149 pp.

ARTICLES IN PERIODICALS

MONTHLY LABOR REVIEW.

October, 1926. "Accidents among Government employees"; "Filipino contract laborers in Hawaii"; "Building permits in principal cities"; "Productivity of labor in various industries"; "Wages and hours in the British steel industry."

November, 1926. "Loans for small borrowers: Status of credit unions"; "Labor conditions of textile workers in India, China, Japan"; "Productivity in meat packing and petroleum refining"; "Wages and hours in men's clothing industry"; "Recent Strikes"; "Meat prices compared with price of livestock."

December, 1926. "Prevalence of five-day week in American industry"; "Norfolk's Municipal Market"; "Wages in British pottery industry"; "Wages in German pottery industry"; "Trend of cotton prices"; "Consumers' Coöperative Congress of 1926"; "Accidents in iron and steel industry."

JOURNAL OF POLITICAL ECONOMY.

December, 1926. W. C. Keirstead: "Rural Taxation in New Brunswick"; A. Joy: "Washington's Minimum-Wage Law"; J. V. Huffman: "Expansion Possibilities of Our Banking System"; R. Peterson: "Teaching the Principles of Economics."

POLITICAL SCIENCE QUARTERLY.

December, 1926. R. L. Schuyler: "Ireland and the English Parliament—An Imperial Phase of the Puritan Revolution"; E. M. Earle: "Egyptian Cotton and the American Civil War"; P. B. Potter: "The Expansion of International Jurisdiction"; M. Mohler: "The Episcopal Church and National Reconciliation, 1865"; H. L. McBain: "Consequences of the President's Unlimited Power of Removal"; W. C. Mitchell: "The Research Fellowships of the Social Science Research Council."

THE ANNALS.

November, 1926. "The Motion Picture in Its Economic and Social Aspects."

JOURNAL OF ACCOUNTANCY.

November, 1926. G. O. May: "Corporate Publicity and the Auditor"; W. Mucklow: "The Accountant and the Real-Estate Developer"; A. P. Richardson: "American Institute of Accountants, Report of the Secretary."

December, 1926. "American Institute of Accountants Examinations, November, 1926"; C. H. Nau: "Treatment of Replacement Reserve Funds"; T. H. Sanders: "Some Variations in Inventory Valuations."

JOURNAL OF THE INSTITUTE OF BANKERS.

November, 1926. K. Cook: "Banking in its Relation to Empire Trade and Empire Development"; R. Moelwyn-Hughes: "Guarding the Guarantor."

December, 1926. Sir J. Ferguson: "Inaugural Address of the President"; G. R. Gallaher: "Public Speaking for Bank Men."

January, 1927. R. G. Hawtrey: "The Gold Standard. Lecture I"; R. A. Wilson: "Some Compensatory Movements in Banking Finance"; Sir J. Ferguson: "A Few Words of Friendly Counsel to the Younger Members of the Institute."

JOURNAL OF THE INSTITUTE OF ACTUARIES.

November, 1926. R. C. Simmonds: "Notes Concerning Some Practical Points That Arise in the Valuation of Widows' Funds"; R. A. Bateman: "Legal Notes."

JOURNAL DE LA SOCIÉTÉ DE STATISTIQUE DE PARIS.

October, 1926. M. Gheorghiu: (à suivre) "Essai sur les finances d'après-guerre de la Roumanie en rapport avec les mouvements économiques européens"; M. Moine: "Variéte: La population actuelle du monde."

November, 1926. M. Gheorghiu: (fin) "Essai sur les finances d'aprèsguerre de la

Roumanie en rapport avec les mouvements économiques européens"; M. A. Bernard: "Observations sur le projet de loi sur les assurances sociales (projet Chauveau)."

December, 1926. M. Huber: (à suivre) "Le Service d'observation des prix"; M. Ichok: "Revue de statistique sanitaire."

GIORNALE DEGLI ECONOMISTI.

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November, 1926. G. Mortara: "Per l'Indipendenza Economica dell'Italia"; F. Carli: "Il Problema del Valore; Parte II."

GIORNALE DI MATEMATICA FINANZIARIA.

August–October, 1926. E. Lenzi: "Di alcune equazioni integrali che interessano la Matematica finanziaria"; F. Insolera: "Sul calcolo del tasso reale di un titolo"; E. Lenzi: "Sulle rendite vitalizie e le assicurazioni in generale"; F. Insolera: "Sulla perequazione col metodo dei momenti"; F. I.: "Alessandro Tchouproff."

METRON.

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MISCELLANEOUS REPRINTS AND PAMPHLETS

DEPARTMENT OF LABOR AND INDUSTRY, COMMONWEALTH OF PENNSYLVANIA. Its Organization and Operation. Special Bulletin, No. 14.

THE ECONOMICS OF WORLD HEALTH, by Louis I. Dublin. Reprinted from *Harper's Monthly Magazine*, November, 1926.

FISH AND GAME COMMISSION OF CALIFORNIA. Fish Bulletin No. 11, The California Sardine.

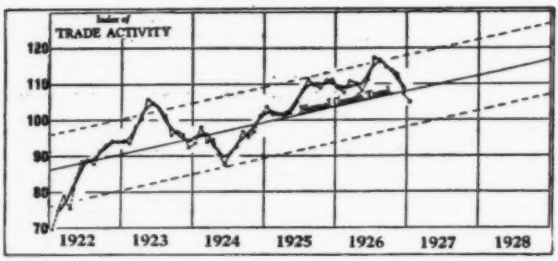
OTHER BOOKS

BOUNIATIAN, MENTOR. *La Loi de Variation de la Valeur et les Mouvements Généraux des Prix*. Paris: Marcel Giard. 1927. 155 pp.

CORNÉLISSEN, CHRISTIAN. *Traité Général de Science Économique*. Paris: Marcel Giard. 1926. 2 vols. 466 and 662 pp.

HANTOS, ELÉMER. *La Monnaie, Ses Systèmes et ses Phénomènes en Europe Centrale*. Paris: Marcel Giard. 1927. 259 pp.

WALSH, CORREA M. *The Four Kinds of Economic Value*. Cambridge, Mass.: Harvard University Press. 1926. 138 pp.



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